MINISTRY OF SCIENCE AND EDUCATION OF THE REPUBLIC OF AZERBAIJAN
INSTITUTE OF BOTANY

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Baku-2023

Taking special care of the rich resources that nature has given to our country, protecting such unique treasures for the sake of the future of mankind is one of our main tasks.

Heydar Aliyev
National Leader of the Azerbaijani people

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«Azerbaijan is a country with a unique ancient culture. There are names of figures belonging to the Azerbaijani nation in the annals of world science. We are proud of them»

Heydar Aliyev

HEYDAR ALIYEV'S ROLE IN THE DEVELOPMENT OF AZERBAIJAN SCIENCE

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May 10, 1923 is the birthday of Heydar Aliyev, world famous politician, the founder of the modern history of Azerbaijan, the great leader who made an unparalleled contribution to the independence of our country. This year marks the 100th anniversary of the birth of a great personality, and the Honorable President of the Republic of Azerbaijan, His Excellency Ilham Aliyev, guided by paragraph 32 of Article 109 of the Constitution of the Republic of Azerbaijan declared 2023 the "Year of Heydar Aliyev" in the Republic of Azerbaijan in order to celebrate 100-anniversary of the national leader of the Azerbaijani people Heydar Aliyev at the state level.

The years of Heydar Aliyev's reign were remembered for adding a number of important pages to the history of the Republic of Azerbaijan, including Azerbaijan science. Even after 1969, Heydar Aliyev, who acted as one of the top leaders of the former USSR, paid special attention to the intensive development of the scientific potential of our republic and the training of new highly qualified scientific personnel. In the 1970s and 1980s, he sent young specialists to the leading scientific institutions of the world to create a base in various fields of science in our republic. Thanks to H.A. Aliyev's foresight, various fields of science, including modern fields of biology such as biochemistry, biophysics, gene biotechnology, bioinformatics, and bioenergetics are developing in our republic.

Today, the scientific-researches of our biologists-scientists directed towards the comprehensive study of plants at the botanical, technological, medical, physico-chemical, cellular, genetic level and, ultimately, the management of agriculture and industry for the benefit of people, are internationally recognized and appreciated.

When Heydar Aliyev made official visits to various countries of the world during the years when he was the head of our republic, he always visited advanced scientific centers, met with prominent figures of science and culture,

including the Azerbaijani intelligentsia living in remote lands, and gave valuable advice.

It should be noted that thanks to the consistent policy of Heydar Aliyev, Azerbaijan was admitted to the Council of Europe, which opened wide opportunities for intellectuals and scientists of our republic.

In modern times, intensification of interstate cooperation, identification of promising scientific directions, conducting research at a high level and applying its results to relevant fields, etc., are real manifestations of these opportunities.

The great leader Heydar Aliyev knew very well that the stable development of Azerbaijan depends very much on the solution of environmental problems. The great leader who managed to create a new social consciousness in Azerbaijan during all periods of his power, at the same time, created a foundation for the formation of a new ecological thought in the republic. A new perspective and correct attitude towards biological diversity has emerged.

The created favorable conditions restored the enthusiasm of our scientists and mobilized them to achieve unprecedented achievements. Biologists also had a share in the achievements. Thus, the plant gene pool of Azerbaijan has been significantly enriched.

At present, this policy is continued by his worthy follower, esteemed President Ilham Aliyev.

Commander-in-Chief, President of the Republic of Azerbaijan Ilham Aliyev, who was able to realize his far-sighted ideas for the liberation of Karabakh from the despised enemy in just 44 days, and surprised the whole world thanks to the courage of our heroic National Army and his new fighting tactics, followed his father's will by signing the Victory. Currently, the construction works carried out in the Karabakh lands and the implementation of various projects bring great joy. Currently, biologists are conducting large-scale research in the direction of the study of the biological diversity of both the republic and Karabakh:

- *The restoration of scientific research in the liberated territories by the Institute of Botany has been accelerated, in cooperation with the relevant departments of the Ministry of Science and Education of the Republic of Azerbaijan, including Azerbaijan National Academy of Sciences, and the relevant state institutions of the republic, multidisciplinary researches on the study of natural and cultural ecosystems, biological diversity, their future development prospects and ensuring biosecurity have been strengthened.*
- *The third edition of the "Red Book" of the Republic of Azerbaijan has been prepared and jointly presented with the Ministry of Ecology and Natural Resources, Azerbaijan National Academy of Sciences and the Ministry of Science and Education. New edition includes up to 460 species, of which more than 220 are newly recommended.*

- *Memorandums have been concluded for the expansion of cooperation relations with prestigious international institutions, participation in joint mega-projects, personnel training in well-known foreign science and educational institutions.*
- *Researches have been conducted on modern approaches to environmental protection as well as the study, restoration and efficient use of natural resources, including biological diversity.*
- *The expansion of the participation of scientists of the institute in the development of textbooks, the inclusion of the latest achievements of modern science in the textbooks of higher and secondary schools have been ensured.*
- *Comprehensive studies on the dynamics of transformation of plant and mushroom biodiversity of Azerbaijan, taxonomic review, systematic-floristic and ecological-geographical analysis of its structure in natural and anthropogenic ecosystems, development of protection means and technologies for efficient use of biological resources have been continued.*

Today, the main task facing our scientists is to justify the trust placed in them, unite closely around the President of the country, and try to protect the statehood of Azerbaijan, strengthen its independence, and increase the intensity of fundamental and applied research for the sake of economic revival.

Heydar Aliyev, who left indelible marks in the annals of our statehood, was proud of being an Azerbaijani throughout his life, and is a source of national pride and honor, is recognized as a symbol of Azerbaijan all over the world. Our people always cherish and gratefully remember his dear memory, and mark the day of his return to power as a national holiday of the Republic of Azerbaijan - National Salvation Day.

Once again, we remember the Great Leader with sensitivity and wish him God's mercy!

CURRENT STATE OF FLORA AND VEGETATION

THE BIOLOGICAL DIVERSITY OF LICHENS IN AZERBAIJAN AND THEIR PROTECTON

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The lichens are a widespread group of organisms in all the plant and climatic zones of theEarth. Thanks to their ecological peculiarities the lichens are found in all the geographical latitudesand various ecological conditions, and play the significant role in the functional system of the nature. They play a great role in the addition and dynamics of many plant associations, especiallyat first stages of the inhabitation of the exposed substrate, and are the "pioneers" of the cliff mastering. The lichens are the composition parts of the most important plant formations of the Azerbaijan, and some of them take the dominant position. The lichens are widely used as the indicators of the air pollution. The practical importance of the lichens for the national economy issignificant. They are used in medicine, cosmetology and confectionery industry; serve as the raw material in obtaining the dyes. The duplicity of the lichens nature, their high ecological plastic is of the interest from the biological point of view. The inadequacy of information about the biodiversity of the lichens in some geographical regions doesn't allow the wide-ranging and exhaustive study of the appropriate ecosystems. That is why the study of the biodiversity and the groundwork of the scientific basis of the plant protection are the urgent tasks of the botanists. The research of the biodiversity is "the basis of any biological research".

In the outcome of work it was found that the lichen flora of Azerbaijan comprises 811 species,6 subspecies out of 24 orders, 62 families and 202 genera (Alverdiyeva S.M., Novruzov V.S).

The lichen flora of Azerbaijan is extremely rich and various. This richness is tied up with the diversity of ecological conditions and geographical location of the territory.

It has been identified that the sharing of environmental and genetic methods in conducting experimental studies of endangered species of flora, opens up new mechanisms of adaptation of different species and reveals the biological characteristics of endangered species.

A TAXONOMIC OVERVIEW OF THE GENUS *TRIFOLIUM* L. OF THE TALYSHFLORA

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The genus *Trifolium* L. (Fam. *Fabaceae*) has more than 160 species distributed in the countries of Eurasia and Africa, especially the Mediterranean with temperate and subtropical climate. During our expeditions organized to the region in 2017-2019, herbarium and seed materials of these species were collected and their biomorphological analysis was conducted. New information was also important in clarifying the species distributed in the republic with disputable status. As a result, it was determined that there are 39 species and 14 species diversity of this genusbelonging to 9 sections and 4 subgenera.

Subgenera	**Sections**	**Species**
Subgen I. *Trifolium*	Sect. 1. *Stenostoma*	*T. canescens, T. topczibashovii, T. caucasicum, T.squamosum, T. echinatum, T. angustifolium*
	Sect.2. *Prosbatostoma*	*T. striatum, T. scabrum, T. phleoides, T. incarnatum*
	Sect. 3. *Trifolium*	*T. medium, T. grossheimii, T. pratense, T.lenkoranicum, T. diffusum, +T. alexandrium, T. hirtum, T.lappaceum, T. issajevii, T. arvense*
	Sect.4.*Lotoidea*	*T. hybridum, T. repens*
	Sect.5. *Micrantheum*	*T. retusum, T. glomeratum, T. suffocatum*
	Sect.6.*Vesicastrum*	*T. spumosum*
Subgen. II. *Calycomorphum*	Sect.7.*Calycomorphum*	*T. subterraneum*
Subgen. III. *Galearia*	Sect. 8. *Galearia*	*T. fragiferum, T. bonannii, T. talyschense, T. tumens, T. resupinatum, T. tomentosum*
Subgen. IV. *Chronosemium*	Sect.9. *Chronosemium*	*T. grandiflorum, T. aureum, T. campestre, T. sebastiani, T. micranthum, T. patens*

The gradient analysis of the species shows their widespread distribution in most mountain zones, and the analysis according to vegetation types shows their uneven distribution in different plant phytocenoses (16 species in forests and bushes; 10 species in different meadow plant groups, etc.). 23 species are

mesophytes, 11 species are xerophytes, and 5 species are mesoxerophytes.

As a result of botanical-geographical analysis, it was determined that the clover (*Trifolium* L.) species of Talysh region belong to 3 areal types (Ancient Mediterranean, Boreal, Pluriregional) and 13 geographical types. The main part of the species of genus (63.2% or 24 species) belongs to the Ancient Mediterranean areal type. Based on this result, it can be assumed that the elements of the ancient Mediterranean flora took an active part in the formation of the clover species in the region and in Azerbaijan.

It was determined that 16 of the 39 clover (*Trifolium* L.*)* species found in the Talysh region are rare and endangered species. Their status was specified using the classification of the International Union for Environmental Protection: 3 species (*T. caucasicum, T. suffocatum, T. tomentosum*) are endangered (CR), 2 species (*T. diffusum, T. hybridum*) are rare (EN), 4 species (*T. spumosum, T. sebastiani, T. echinatum, T. scabrum*) near the dangerous limit (NT) and 7 species (*T. squamosum, T. angustifolium, T. medium, T. hirtum, T. subterraneum, T. phleoides, T.grossheimii*) are plants sensitive to environmental factors (VU). These results show that the growth conditions of three-leaf clover species in the study area are fundamentally affected by anthropogenic influence. 1 species - *T. bithynicum* (*T. grossheimii*) is included in the III edition of the "Red Book of the Republic of Azerbaijan". *In situ* conservation of other species is recommended.

THE FIRST FINDINGS OF *GAGEA MIRABILIS* GROSSH. IN THE SOUTHERN URALS

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The research work was carried out to study representatives of the genus *Gagea* Salisb. (*Liliaceae* Juss.) in the Southern Urals in 2020-2023. Two cenopopulations of *Gagea mirabilis* Grossh. were found during field studies on the territory of the Chelyabinsk region and the Republicof Bashkortostan. These localities of the species are indicated for the first time for the flora of these territories.

G. mirabilis is a perennial herbaceous bulbous polycarpic. It reproduces mainly by vegetative rudiments (bulbs that form instead of flowers on modified peduncles and in the basal part of the shoot), less often by seeds. It is listed in the Red Book of the Orenburg Region (2018) as a rare species (status – 3) and in the Red Book of the Samara region (2017) as an undeterminedspecies (status – 4). The area covers the south-east of the European part of Russia (isolated locations in the Volga region are indicated), the south of Western Siberia (this indication for the Irtysh region needs confirmation) and the north of Central Asia (the north-western part of Kazakhstan: Aktobe and West Kazakhstan regions). Some authors consider it as part of the polymorphic species *G. liotardii* (Sternb.) Schult. et Schult. f. The species lives in damp meadowsand in steppe depressions.

The large cenopopulation of *G. mirabilis* was discovered in May 2021, 3 km north of the Bredy village and 4 km northeast of Mirnoye village of Bredinsky district of Chelyabinsk region (52°27'19.5" s.w.; 60°19'05.2" v.d.; altitude above sea level 332 m). The cenopopulation is locatedwithin a temporary drainage hollow in a small birch forest surrounded by a motley grass-cereal steppe. The soils are alluvial, sandy-clay, with gravel outcrops on the surface. The cenopopulation experiences a strong anthropogenic impact in the form of grazing. There are 31 species in the community, dominated by *Artemisia austriaca* Jacq., *Festuca valesiaca* Gaudin, *Elytrigia repens*(L.) Nevski, *Carex pilosa* Scop., *Tulipa biebersteiniana* Schult.et Schult. f., *Gagea mirabilis*. *Potentilla humifusa* Willd. ex Schltdl, *P. argentea* L., *Fritillaria ruthenica* Wikstr., *Achillea millefolium* L., *Sanguisorba officinalis* L., *Fragaria viridis* Weston were noted in the various grasses. The height of the tree tier is 8-12 m, grassy – 0,1-0,2 m. Moss-lichen cover is poorly developed. The total projective coverage is 65-70%, the projective coverage of *G. mirabilis* is 25-30%.

A cenopopulation discovered in April 2022, 3 km southwest of Tashtugai village of the Khaibullinsky district of Bashkortostan (51°56'36.2" s.w.; 58°34'43.4" v.d.; altitude above sea level 327 m). The cenopopulation is located in a small depression in the loose sediments of a temporary drainage hollow, which is part of a petrophytic-grass steppe with fragments of shrub communities. The soils are alluvial, sandy-clay, with gravel outcrops on the surface. The cenopopulation experiences an average anthropogenic impact in the form of grazing. There are 23 species in the community, dominated by *Gagea mirabilis*, *Festuca valesiaca*, *Achillea millefolium*.*Artemisia commutata* Besser, *Potentilla argentea*, *Tulipa biebersteiniana* were noted in the various grasses. The height of the shrub layer is 0,4-0,6 m, grassy layer – 0,1-0,3 m. Moss-lichen cover is poorly developed. The total projective coverage is 45-50%, the projective coverage of *Gagea mirabilis* is 50-55%.

Herbarium collections confirming the above findings are stored in the Herbarium of the Botanical Garden of Chelyabinsk State University (CSUH). These findings confirm that *G. mirabilis* is confined to steppe and dry meadows with high soil moisture and quite significantly expand the idea of the distribution and the northern border of this species. Of course, monitoring studies of the condition of cenopopulations of a rare species for the Southern Urals are needed.

ALIEN SPECIES *AILANTHUS ALTISSIMA* (MILL.) SWINGLE (SIMAROUBACEAE DC.) IN AZERBAIJAN

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Ailanthus altissima (Mill.) Swingle, tree of heaven, Chinese tree of heavenis a fast growing tree reaching a height of 12-15 m, originally from Taiwan and central China. The distribution of *A. altissima* in Azerbaijan has occurred presumably since the beginning of the 20th century and is associated with the introduction for decorative purposes. Later, by the middle of the century, the species began to be purposefully bred in order to afforest dry hills, slopes, roadside lanes, parks, roadsides in Absheron, and then throughout the republic.

At present, *A. altissima* in Azerbaijan has strengthened itself not only in the initial centers ofits introduction, but has also actively spread throughout the country - from the lowlands to the uppermountain belt (-27m - 1200 (1600) m a.s.l.), showing tolerance to a wide range of relief, soil and climatic conditions. According to literature data based on seed traits *A. altissima* is able to differentiate into subpopulations. Thus, *A. altissima* with bright red samaras compared to the more common greenish-yellow samaras was distinguished by researchers as *Ailanthus altissima* var. *erythrocarpa* (Carr.) Rehd. Both options are found in Azerbaijan. The most vulnerable to the introduction of ailanthus are shrub, forest, riverine, coastal local ecosystems, which contact with settlements and cities, or located in the zone of tourist sites. Our studies have shown that in the central and most arid part of Azerbaijan (the Kura-Araz lowland), *A. altissima* occupies villages and their environs, from where it invades the vast riverine areas of the Kura strip adjacent to them and variouswetland formations. Penetrating into coastal river ecosystems, it displaces species such as *Populus alba* L., *Salix excelsior*, *Tamarix ramosissima* Ledeb., *Phragmites australis* (Cav.) Trin. ex Steud., that have already thinned out because of felling and in some places forming unique adventive forest. A similar situation occurs in the northern (Khachmaz district) and southern parts (Lankaran, Astara districts) of Azerbaijan part of the Caspian strip. As a result of the introduction of *A. altissima*, we have extensively recorded along the roadside strip crossing forest and shrub vegetation, within 600 - 1100 m above sea level throughout Azerbaijan part of the Greater Caucasus and locally in the LesserCaucasus.

Plant shoots are quite shade-tolerant and successfully develop in the undergrowth. Among theforest communities, the following can be mentioned - hornbeam - beech forests of the middle mountain belt, poplar - willow of lowland forests, as well as marsh reed communities of the seaside strip.

BIOECOLOGICAL FEATURES OF THE SPECIES OF GENUS *SEMPERVIVUM* L. DISTRIBUTED IN THE NORTHERN PART OF THE LESSER CAUCASUS

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In the territory of our republic, representatives of the *Crassulaceae* D.C. family are distributed in most regions, from the lower mountain belt to the alpine belt, mostly in mountainous areas, stony and rocky places, river valleys, forests etc. According to I.Karyagin, 4 genera of the *Crassulaceae* D.C. family (*Crassula* L. (Tillaea), *Sedum* L., *Sempervivum* L. and *Rosularia* (DC.) Stapf) are found in the flora of Azerbaijan, but according to the latest references, the family is now represented by 3 genera in the territory of Azerbaijan. Representatives of the genus *Crassula* L. (Tillaea) are not found in the territory of Azerbaijan (Asgarov A.M. The plant world of Azerbaijan, Baku, 2008, p. 198-200). 18 species of the *Crassulaceae* family are distributed in the Lesser Caucasus.

Expeditions were organized to the territory of Tovuz, Gadabey, Dashkasan and Goranboy regions, and herbariums were collected. The geographical position of the species belonging to the genera *Sedum* and *Sempervivum* has been investigated, their distribution in the flora and their morphological and bioecological characteristics have been determined.

It was defined that 4 species of *Sedum* L. genus are distributed in the northern part of the Lesser Caucasus: *Sedum album* L., *Sedum spurium* M.Bieb, *Sedum oppositifolium* Sims, *Sedum caucasicum* (A.Grossh, A.Bor). Only 1 species of *Sempervivum* genus - *Sempervivum globiferum* (Jovibarba globifera) is found in the research area. The main purpose of the conducted research is to determine the taxonomy of the species included in these genera, their distribution areas, and to study the morphological and bioecological characteristics of those species. For identification morphological and bioecological characteristics of *Sedum* (rabbit cabbage) and *Sempervivum* species were used determinants and many references as well as "Flora of Azerbaijan", "Flora of Caucasus". The latest nomenclatures are used as the basis for determining the species.

Sempervivum globiferum (Jovibarba globifera) is a succulent plant that forms hemispherical rosettes of green leaves usually with red-brown tips. Rosette leaves are fleshy, globose, all edges are curved, and root leaves are ovate. The flowers are star-shaped, pale greenish-yellow or yellow. In summer, the flowers are borne on peduncles which can reach to 20 cm tall. The flowers are easily detached from the mother plant, forming small, spherical offsets that

roll. Due to their biological characteristics, the species included in the studied genera are adapted to live in a wide range of habitats in difficult natural conditions. Molecular-phylogenetic studies are planned to determine the distribution areas of the *Sempervivum globiferum* species in the study area, and to determine the statusof the species.

SOME WOODY PLANTS ARE USED IN THE LANDSCAPE OF ABSHERON

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Greening cities and towns, building new parks and squares, enriching them with new ornamental plants are topical issues of our time. Landscaping is one of the main elements of artistic and architectural design of working conditions. Plants selected for landscaping should be chosen according to their decorative effect and durability. Landscaping of cities, towns and other settlements is an integral part of nature protection and environmental measures. Greening of cities, towns and other settlements is an integral part of environmental protection and measures. Landscaping, including the green zone around the city, not only improves sanitary and hygienic conditions. The Caucasian flora used in the landscaping of the city and surroundings of Azerbaijan, the territorial introduction zone (the Absheron Plain), covering the flora of North America and the Mediterranean, has its own floral spectrum. The article presents an assessment of the dominant species for their ecological stability and prospects in the conditions of dry subtropics. The trees and shrubs are listed below. Currently, 346 species of trees and shrubs are grown in the landscaping of cities and towns of Azerbaijan. They consist of 166 shrubs and 168 trees, including 99 (Caucasus), 79 (East Asia), 50 (North America), 25 (Mediterranean), 16 (Europe), 8 (Central Asia) and 21(from the other regions) species. From these, 36 are garden forms and hybrids, 12 are fruit plants. *Acer* L., Cotinus Mill., *Corylus* L., *Colutea* I., *Cotoneaster* Medik., *Crataegus* L., *Euonumus* L. *Gleditisa* L., *Fagus* L., *Paliurus* Mill., *Picea* Dietr., *Pinus* L., *Piracantha* Boem., *Pistaca* L., *Platanus* L., *Populus* L., *Punica* L., *Pyrus* L., *Rhamnus* L., *Rhus* L., *Salix* L., *Sorbus* L., *Taxus* L., *Tilia* L., *Ulmus* L., *Zelkova* Spach., *Zizipus* Mill. genera are included in the type of caesorophytes. Mediterranean and North American species are more promising, as they have ecological plasticity. Here: *Berberis* orientalis C. Koch., *Ficus carica* L., *Platanus orienralis* L., *Pinus pinea* L., *Juniperus rufesccens* Link., *Salix alba* L., *Carpinus orientalis* Mill., *Punica granatum* L., *Alcea rosea* L., *Malvanicaensis* All., *Arbutus andrachne* L., *Pinus pallasiana* Lambert., *Jasminum fruticans* L., *Rhus coriaria* L., *Cotinus coggygria* Scop., *Colutea*

cilicica Boiss.et ., *C.armenia* Boiss.et ., *Galanrus apinus* Sosn., *Pinus kochiana* Klotzsch., *Ornithogalum sigmoideum* fr.et Sint., *Sedum caucasicum* Gros., *S.obtusifolium* C.A.Mey., *Sempervivum globiferum* L., *Rhamnus pallasii* Fish.et.Mey. and *Pyrus, Rosa, Buxus colchica* Pojark., *Dioscorea caucasica* Lipsky., *Festuca orundinaceae* Scherb., *Menthalongifolia* L., *Cotoneaster melanocarpa* Lodd., *Fraxinus excelsior* L., *Taxus bacata* L., *Hedera helix* L., *Vinca mior* L., *Buplerum rotindifolium* L., *Pinus hamata* Stev., *Juniperus oblonga* L., *Carpinus caucasica* Grossh., *Populus hebrida* Mib., *Pinus eldarica* Medw., *Thuja occidentalis* L., *Cupressus sempervirens* L., *C.lusitanica* L., *Ulmus lavis* Pall., *U.suberosa* Maench., *Celtis caucasica* Willd., *Berberis vulgaris* L., *B. berca* Stev., *Pittosporum tobira* Ait. et Fish. According to the conducted research, plants of Mediterranean, North American and East Asian origin, which are always green and shed their foliage, naturally develop in parks and gardens of Absheron are resistant to heat, frost and drought. As a result of many years of research, it has been established that the study of the bioecological characteristics of these trees and shrubs fully corresponds to the climate and soil zone of Absheron. The studied plants grow normally, bloom and produce high-quality seeds. To solve the ecological problem, the study of biology, biomorphology, growth and development, morphogenesis, ontogenesis, ecology, reproduction, agrotechnics of these plants is one of the most important issues.

THE GENERA AND SPECIES OF THE FAMILY *NECKERACEAE* SCHIMP DISTRIBUTED IN AZERBAIJAN

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Mosses occupy a special place in the species diversity of plants. The aim of the study was to investigate the species belonging to the *Neckeraceae* family.

Family ***Neckeraceae*** Schimp.Genus ***Neckera*** Hedw.

Neckera pennata Hedw., Published In: Species Muscorum Frondosorum 200–201.1801. Ecology: On tree trunks in mixed forests, mesoxerophyte.

Distribution: Greater Caucasus (GC): Zagatala district; Lesser Caucasus (LC): Nakhchivan AR

Neckera complanata (Hedw.) Hueb., Muscol. Germ. 576. 1833. Ecology: Rotten stump in forest, rarely on stone, mesoxerophyte.

Distribution: GC: Zagatala, Oghuz, Gabala; Guba and Shabran districts; LC: Goygol and Tovuz districts; Talysh: Lankaran, Masalli, Lerik and Astara districts

Neckera besseri (Lob.) Jur., Verh. Zool.-Bot. Ges.Wien 10: 368. 1860.

Ecology: On the trunk of trees in the forest, on large stones and soil. Mesoxerophyte. Distribution: GC: Zagatala, Sheki, Oghuz, Gabala, Khachmaz, Guba, and Khudat districts; Talysh: Lankaran, Masalli, Lerik and Astara districts

Neckera crispa Hedw.,Sp. Musc. Frond. 206. 1801. Ecology: On tree trunks in forest, mesophyte.

Distribution: GC: Zagatala district; LC: Nakhcivan AR

Neckera oligocarpa Bruch., Dispositio Muscorum in Scandinavia hucusque Cognitorum 1. 1842.Ecology: On shrubs, xerophyte.

Distribution: LC: Garayazi Nature Reserve

Genus ***Homalia*** Brid.

Homalia trichomanoides (Hedw.) Brid., Bryologia Universa 2: 812. 1827.

Ecology: Mesoxerophyte in the middle montane forest, on sandy rocks. Distribution: GC: Zagatala district.

Genus ***Thamnobryum*** Nieuwl.

Thamnobryum alopecurum (Hedw.) Gang., Mosses E. India 5: 1452. 1976.Ecology: In wet soils, on rocks, rotten trees and stumps. Mesohygrophyte.

Distribution: GC: Zagatala and Guba districts; LC: Goygol district; Talysh: Lankaran district;Nakhchivan AR.

EFFECTS OF ENVIRONMENTAL FACTORS ON ORNAMENTAL TREES IN NUKUS (UZBEKISTAN)

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Trees are important in human life. It is no secret that the study of the impact of anthropogenic factors on the ecological state of the environment has become an urgent problem today. Air, which isone of the ecological factors, is a mixture of gases in the atmosphere, and its composition changes depending on the condition of the vegetation cover and ornamental trees in it. Air is one of the elements necessary for living organisms to breathe.

Trees that absorb heavy metals and trace elements well are deciduous trees (fir, pine and etc.). They act as indicators of air pollution, because the formation of necrosis on their bodies and the shedding of noses indicate that there are too many toxic compounds in the air. Based on the scientific research conducted in our country and abroad, the electrical condition of the air is of special hygienic importance. Organic substances emitted by plants have a great influence on air ionization; it ensures the accumulation of negative ions, which are necessary for human health. Exceeding the amount of different gases in the air is at different levels in different places and cities of the world. In large cities of Uzbekistan, the level of air pollution is increasing day by day, and there are cases of not being able to quickly meet sanitary and hygienic requirements. For example, vehicles in the city of Tashkent emit more than 260-380 thousand tons of various waste gases per year. This indicator is 200-220 thousand tons in the city of Nukus. One of the main factors affecting the environmental condition of the city of Nukus is transport and nearby industries. One of the ways to improve the ecosystem of the urban environment, it is important to solve the problems of optimizing the urban environment by studying the bioecological characteristics of plants in it. Because plants clean the air from harmful gases, trap dust, produce oxygen, essential oils, phytoncides and other useful substances. Green plants have a positive effect on the human nervous system and mental state. At the same time, it affects the microclimate of the city, lowering the air temperature and increasing its humidity during the hot summer days. In addition, one of the unique aspects of trees is that they have the ability to significantly reduce noise. As mentioned above, plants are constantly under the influence of environmental factors, and they have a combined effect on the plant,

which increases the range of the species and its resistance to interspecies competition.

The level of decorativeness, sanitary-hygienic, biological properties of plants grown in urban conditions, as well as heat and cold tolerance are important. Therefore, the response of plants to environmental factors in different climatic conditions has been widely studied. According to scientificsources, cold tolerance of plants is a feature reinforced by genetic characteristics of the species. A plant's resistance to cold or heat is usually more pronounced in extreme conditions. A number of studies show that the resistance of plants to cold or heat also depends on its age. Cold tolerance is related to the geographical origin of the plants. Also, plants with a wide natural area are quickly adaptable and resistant to environmental factors. In the conditions of Nukus, frequently repeated winter warmth and late spring cold are a serious obstacle in the acclimatization of plants. During theconducted studies, the main environmental factor affecting the conditions of the city of Nukus is the movement of vehicles. Of course, in the process of urbanization of cities, the increase of vehicles is a natural phenomenon. But this situation is a problem.

DISTRIBUTION OF *ASTRAGALUS RUBRIVENOSUS* GONTSCH.

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The flora of the Tashkent region covers the Chatkal, Ugom, Pskem, and Kurama ranges of the Western Tien Shan mountain ranges. At present, the creation of a complete cadastral list of the flora of the region, the study and documentation of their diversity are being carried out by the staff of the laboratory of rare plant species cadastre and monitoring of the Botanical Institute of the Academy of Science of the Republic of Uzbekistan. During the research, special attention is paid to the study of the rare and endangered species of Tashkent region, in particular those included in the Red Book of the Republic of Uzbekistan, and to the creation of a cadastral list of them. *Astragalus rubrivenosus* Gontsch. is among these rare, endemic, and endangered species.

Astragalus rubrivenosus Gontsch., Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 9: 146 (1946).

Type: Uzbekistan. Aksek-ata, 1936, E. Korotkova et V. Titov (TASH).

Morphological description. 3-4 cm tall perennial herb. The length of the leaf is 10–12 cm; theleaves are elliptic with a sharp tip; the upper side is sparse; and the lower side is hairy. The length ofthe flower stalk is 12-15 cm. The calyx is swollen with reticulate veins. The length of the pod is 13–14 mm, and the width is 0.5 cm. It blooms in June, and the fruit ripens in July.

A. rubrivenosus grows in the middle of the mountains, on gravelly, rocky slopes, at an altitudeof 1800–2000 m above sea level.

Distribution.

The distribution area of the species does not go beyond the territory of Uzbekistan. According to herbarium and expedition data, *A. rubrivenosus* is distributed in Aksoqotasoy, Boshqizilsoy, Teraklisoy, Ertoshsoy, Bildirsoy, and Amirsoy areas of the Chatkal ridge at altitudes of 1500–2200 m above sea level. (Fig. 1). Most of the habitats are located in the Bashkizilsoy river basin in the Chotkal State Biosphere Reserve. This area is one of the main areas of biodiversity (KBA) in Uzbekistan.

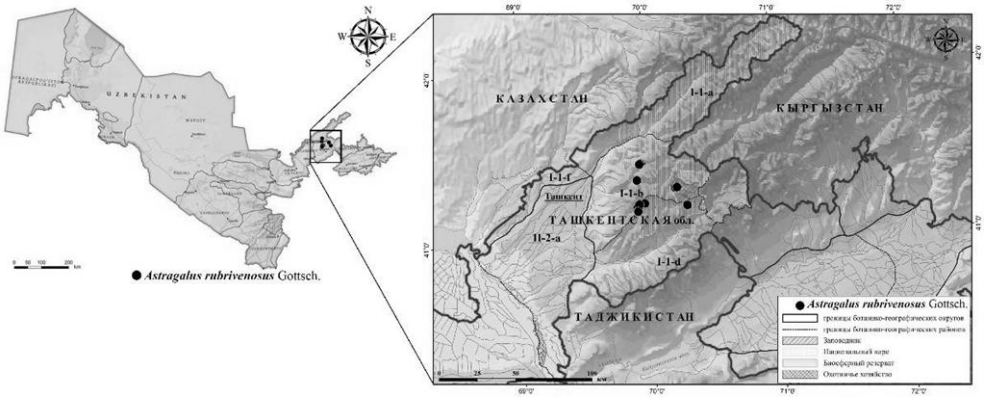

Figure 1. Distribution map of *Astragalus rubrivenosus* in Central Asia.

A. rubrivenosus is one of the rare and endemic species preserved in very small areas of the Western Tien Shan mountain ranges. According to Goncharov (1946) and Shermatov (1981), the Chotkal ridge grows near the Oksok-ota mountain river, and in the first edition of the flora of Uzbekistan and in the Red Book of the Chotkal ridge of the Tashkent region, Aksek-atasoy, Bashkizilsoy, Ertoshsoy, and Serkalisoy are listed as endemic species.

DISTRIBUTION OF *JUNIPERUS FOETIDISSIMA* WILLD. IN AZERBAIJAN

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Juniperus foetidissima Willd. (conservation status LC–Least Concern) is a species that requires little care and according to the international system, is included to the Red Book of Azerbaijan under categories A4a; Bb (I, II, III, IV). Depending on the life form, they are 5-6 m sometimes up to 16 m tall, pyramid-shaped trees or 1.5 m tall shrubs. The branches of the plant are quite dense and form an oval crown. The branching is mostly monopodial and the branches are curved upwards. The bark of the trunk is gray, in young trees it becomes brownish-reddish. The branches are dense, quadrangular and the bark can be easily turn off. Coniferous leaves are all scaly, dark green in color, elongated rhomboid or lanceolate rhomboid in shape, 2-10 mm long, not very densely joined to the stem. The tips of needle-like leaves are usually sharp and give an unpleasant smell when crushed. In some cases, young trees with conifers arranged in three-by-three balls are also encountered, in this case, the length of the conifers is 4-10 mm and the width is 2 mm. The plant is monoecious or dioecious. The berry-shaped cones are about 10 mm in diameter, egg-shaped or yellow, black-reddish, in most cases black with a wax-like covering. The seeds are 1-2, rarely 3, oval-shaped, light-brown in color. Pollination occurs in April-May, it reproduces by seeds and spraying. The cones fully ripen in October-December of the second year. Seed dispersal is zoochorous, pollination is anemophilic. It is a mesophyte according to its water requirement and a mesotherm according to its soil temperature regime.

The root system of *J.foetidissima* Willd. is spread both in the upper and deep layers of the soil. It uses both atmospheric sediments and groundwater for its water supply. According to the literature, the average lifespan is about 300-400 years. *Juniperus foetidissima* is not demanding on the composition of the soil, it is relatively resistant to salinity. These trees grow on cliffs at an altitude ofup to 1600 m above sea level (a.s.l.).

Compared to *Juniperus polycarpos* K.Koch., this species is more xerophytic, which allows them to spread at an altitude of 1800-2000 meters a.s.l. The mentioned species is usually found as a subdominant species in plant groups formed by the presence of *Juniperus polycarpos* and rarely in pure plant groups between rocks.

In the territory of Azerbaijan, this plant is distributed in the Greater and Lesser Caucasus, as well as in the medium and high mountain belt of the Nakhchivan Autonomous Republic. In the Shamkirchay basin, juniper is distributed within the juniper-pistachio (Junipero-Pistaciosum) association, and in the territory of the Nakhchivan Autonomous Republic. *J. foetidissima* is detected in the Alhago-Juniperosum association. In the territory of Turyanchay State Nature Reserve, it is found in the Juniperotum polycarpotum-Juniperus foetidisosum and Juniperotum foetidissosum- Rubosum associations.

BIOECOLOGICAL CHARACTERISTICS AND FODDER POTENTIAL OF VARIOUS HERBACEOUS FORAGE GROUP PLANTS OF LOWLAND AND UNFORESTED ARID AREAS

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The diversity of the vegetation of the lowlands, foothills and arid regions without forests has led to the diversity of their fodder sort. It includes Samukh, Shamkir districts, Ganja suburbs, partly lowland areas of Tovuz district and Bozgir plateau (including Jeyranchol and Ajinohur). The speciesbelonging to the diverse fodder group, which are widely distributed in the grasslands and meadows of the area are of special importance for winter pastures. In the vegetation landscapes that occur naturally in the mentioned regions, plants belonging to all fodder groups, including those belonging to the diverse group, are widely distributed. Among them, there are species that have high feed value and can play a big role in the development of the feed base in the winter pastures in those zones.

Various grasses are found as a component in phytocenoses in all types of vegetation - deserts, semi-deserts, steppes, meadows etc. Many of these representatives manifest themselves as dominantor builders of phytocenoses. In the natural forage areas, the representatives of the diversity have a large mass and are tall compared to other forage groups (cereals and legumes). They create conditions for phytocenoses to be highly productive. Such phytocenoses are more common in thickets anddepressions. In the phytocenoses, which mainly consist of various species, grains and legumes are rarely found in the fodder groups. Their role in the productivity of phytocenosis feed mass is not felt. Among the various grasses in the arid regions without forests, the most are *Artemisia* - 5 species, *Salsola* - 3 species, *Veronica* - 3 species of perennials, 6 species of annuals and biennials, Polygonum - 4 species of perennials, 1 species of annuals, geranium, goosefoot, nettle, bedstraw (ofthe genus 2 species of each) and so on. is the majority. But there are also genus that, although they are represented by 1 species (for example, chicory, mallow, scotch thistle, shepherds purse etc.), have a wider range, and the quality of feed is superior to others.

Many types of wormwood, which are satellites of winter pastures, play a role in the formationof the coenosis by forming widespread mixed phytocenoses with ephemeral and shoranga plants. These phytocenoses play an important role in forage balance by forming the basis of fodder areas in winter pastures. Some species of wormwood, especially the high-forage field wormwood (*Artemisia szowitsiana* (Bess.) Grossh.) are eagerly eaten by cattle in the fall and winter

seasons. Due to the factthat the soil cover of a large part of the winter pastures is salty, the types of sorghum are widespreadhere. Of these, the edifice is made up of saltwort (*Salsola dendroides*), fragile saltwort (*Salsola ericoides*), salsola (*Salsola verrucosa*) and others. In some places, these species form special forests. In many cases, wormwood species together with wormwood create wormwood - sorghum phytocenoses. As for the degree of consumption of sorghum species, salsola and saltworm are sufficiently eaten by cattle.

In lowland and arid regions without forests, annual halophyte plants coexist with multifloral species – Orach (*Atriplex patula* L., *A. tatarica* L.,) Goosefoot (*Chenopodium album* L.) and others. with a wider distribution, they participate mainly as components in winter pastures.

NATURAL ILLUSTRATION OF THE SPECIES *TARAXACUM JUZEPCZUKII* SCHISCHK

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The biogeography, phylogeny and genetic diversity of *Taraxacum* F.H. Wigg. species have not been fully studied due to numerous hybridization events, frequent polyploidy and apomixis reproduction, as well as the limited number of studies related to species diversity and distribution. It is one of the least studied taxa for the flora of Uzbekistan. The results of the last research were recorded in "Flora of Uzbekistan" (1962). For more than 60 years, there have been no targeted field studies on the species of this group. From this point of view, studies have been started in order to clarify the taxonomic and geographical confusion of the species of the genus distributed in the Fergana Valley.

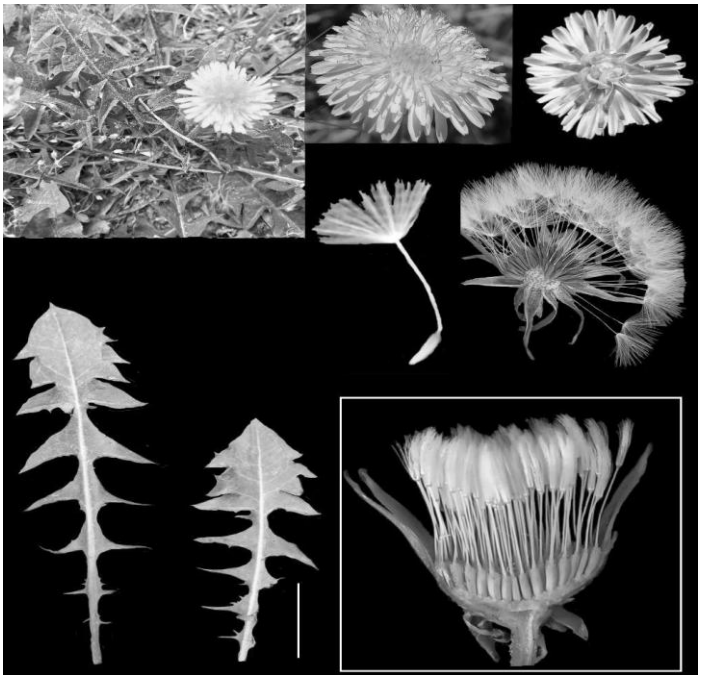

Figure 1. Natural illustration of the species *Taraxacum juzepczukii* Schischk (Photo by B. Tokhtasinov).

Today, the species of this group are among the least studied taxa for the flora of Uzbekistan. For this reason, in order to carry out a systematic and

geographical analysis of the species distributed in the Fergana Valley, targeted research is being conducted by the Department of Biology of Namangan State University. The native range of *Taraxacum juzepczukii* is Iran to Central Asia and Afghanistan. It is a perennial and grows primarily in the temperate biome (Fig.1.).

TO THE STUDY OF THE GENUS *NEPETA* L. (*LAMIACEAE*) IN AZERBAIJAN

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The genus *Nepeta* L. belongs to the tribe *Nepetae* Benth. of the family *Lamiaceae* Martinov and occupies a dominant position both in the number of species and in its vast range. The range of this genus, numbering about 250 species, covers the temperate and subtropical regions of Eurasia and partly Africa. The vast majority of this species grows in the mountains of the ancient Mediterranean region, from the foothills to the Alpine belt. The genus *Nepeta* is most abundant in terms of species in two areas: in Western Asia (especially in Iran) and in the Western Himalayas.

This genus is one of the taxonomically complex ones, which is due to the extreme polymorphism and variability of quite inconsistent morphological characters, and promising in practical terms in the *Lamiaceae* family. Its species are widely used in folk medicine, are essential, fatty oil, vitamin- bearing, ornamental and melliferous plants.

As a result of processing herbarium material stored in the Herbarium of the Institute of Botany (BAK), own collections, also analysis of floristic and taxonomic literature on this genus, it was established that 18 species and 5 subspecies of the genus *Nepeta* grow in Azerbaijan instead of 26 species listed in the "Flora of Azerbaijan" (1957). Some species have undergone nomenclature changes. Thus, 7 species (*N.somkhetica* Kapeller, *N.grossheimii* Pojark., *N.strictifolia* Pojark., N.*buhsei* Pojark., *N.noraschenica* Grossh., *N.daghestanica* Pojark., *N.buschii* Sosn. et Manden.) were relegated to the rank of subspecies, and 1 species, *N.velutina* Pojark., was assigned to the synonyms of *N.trautvetteri* Boiss. et Bushe.

Azerbaijani species of the genus *Nepeta* belong to 6 sections. The most widely represented species are in the section of *Nepeta*: *N.cataria* L., *N.betonicifolia* C.A.Mey., *N.grandiflora* Bieb., *N.zangezura* Grossh., *N.cyanea* Stev., *N.racemosa* Lam.(=*N.transcaucasica* Grossh.);

Sect. *Schyzocalix* Pojark.: *N.teucrifolia* Willd.(=*N.fissa* C.A.Mey.), *N.trautvetteri*, *N.longituba* Pojark., *N.sosnowskyi* Asker., *N.lamiifolia* Willd.

Sect. *Orthonepeta* Benth.: *N.nuda* L. (=*N.pannonica* L.), *N. sulphurea* C.Koch;

Sect. *Micrantha* (Boiss.) Pojark.: *N.amoena* Stapf., *N.meyeri* Benth.;

Sect. *Oxynepeta* Benth.:*N.ucranica* L. (= *N.schischkinii* Pojark.), *N.involucrata* (Bunge) Bornm. (= *N.erivanensis* Grossh.);

Sect. *Denudata* (Briq.) A.Budantz.: *N.supina* Stev.

Species of *Nepeta* genus growing in Azerbaijan are mostly perennial herbaceous plants (16 species), but two of them (*N.amoena*, *N.meyeri*) are annuals. They are confined mainly to mountainous areas. They grow in all mountain belts up to subalpine and alpine, but are most abundantly represented in the middle and upper belts of the mountains. Some species (steppe and annuals), irradiate to the foothills and lowland regions are part of the semi-desert vegetation. According to their habitat, species of this genus are mesophytes, cryophilic hemixerophytes or upland xerophytes. Of the studied species, 7 were described from Azerbaijan (Talysh - 3 species, Greater Caucasus - 4 species). The most widespread species on the territory of the republic is *N.racemosa* (=*N.transcaucasica*), 4 species are found only in the Greater Caucasus, 2 species - only in the Nakhchivan and 1 species in the Talysh. New localities of some species (*N.zangezura, N.cyanea, N.lamiifolia, N.amoena)* have been identified. Based on the analysis of the ranges of the considered species, the composition of the floristic elements of the genus in Azerbaijan was determined. Azerbaijani species of the genus *Nepeta* belong to the following flora elements: Iranian-Turanian-10 species, Caucasian -2 species, Palearctic - 2 species, Euro-Siberian - 2 species.

PHYLOGENETIC RELATIONSHIPS OF *HYPERICUM* L. SPECIES DISTRIBUTED IN AZERBAIJAN

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One of the oldest and largest families according to the origin of the order *Malpighiales* Bercht.& J. Presl. represented by about 1,600 species, is the St.-John's-wort family (*Hypericaceae* Juss.). Thus, the remains of fruits and seeds of the representatives of this family are found in the 1st geological (Paleogene) period of the Caenozoic era. *Hypericum* L. is considered the largest and most ancient genus of this family. The fact that most of the species belonging to the genus are endemic andrelict plants of the third period proves the antiquity of the genus.

The family *Hypericaceae* is divided into 1 subfamily (*Hypericoideae* Engl.) and 3 tribes (*Cratoxyleae* Benth., *Hypericae* Choisy., *Vismiae* Choisy.) represented by 9 genera. In the flora of Azerbaijan, only representatives of the genus Hypericum included in the tribe *Hypericae* are found.

The complex taxonomic structure of the genus *Hypericum* makes it difficult to explain from which genus it originated. Based on research conducted by various researchers on the phylogeny, paleobiology of the genus and the results of our own research, we agree with the idea that this genus originated from an ancestor of Western Palearctic origin with the following diagnostic features: tall, bushy, sessile cuticular leaves, small-flowered, shedding crown and petal, adjacent base, 5-bundlestamen, parietal placenta, free-style, capitate stomata and etc.

Thus, the presence of sections (*Androsaemum, Campylosporus, Bupleuroides, Hypericum, Olympia, Thasia, Drosocarpium, Oligostema, Hirtella, Taeniocarpium, Coridium*) of paleartic origin, endemic, tertiary relict species in the composition of genus St. John's wort, as well as distribution of species from palearctic, equatorial zone to tropical and subtropical countries of the northern hemisphere is a visual proof of the antiquity of this genus.

The center of formation of species belonging to the genus St.John's wort divided into two parts: the Mediterranean and the Eurasian center. The Mediterranean is considered the center of species formation of the vast majority of species belonging to the genus. The Eurasian Center is considered the second relatively young species formation center. 72% of the species inhabiting Central Eurasia are found in tropical (high mountain ranges) and 42% in temperate (medium mountain ranges) countries.

The study of the species of the genus *Hypericum* is of great importance

in the investigation of many unresolved issues related to the phylogenetic of the genus. As a result of research conducted bymany scientists and analysis of the literature, the geography of the species was analyzed.

During the chorological analysis of species of genus St. John's wort distributed in the flora of Azerbaijan, 7 geographical elements were identified on the basis of N.N.Portenier's system. Thus, most of the species found in the flora of Azerbaijan (36%) belong to the Iran-Turan geographical element

Endemic and tertiary relict species are also found in the composition of the genus St. John's wort. The list of endemic species was specified in accordance with the "Red List of endemic plants of the Caucasus". Based on this work, it was determined that 3 (*H. formosissimum* Takht., *H. nummularioides* Trautv., *H. xylosteifolium* (Spach) N.Robson) of the species distributed in the flora of Azerbaijan are endemic to Caucasus and 2 (*H. karjaginii* Rzazade., *H. theodorii* Woronov.) are endemic to Azerbaijan. Also, 2 out of 19 species found in our flora are relict (*H. androsaemum* L., *H. xylosteifolium* (Spach.) N.Robson) plants from the glacial period.

ON THE IMPORTANCE OF THE GENUS *RUBIA* L. (*RUBIACEAE* JUSS.) OF AZERBAIJAN

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Family *Rubiaceae* Juss. includes 450-500 genera with 6000-7000 species distributed in both hemispheres, especially in tropical countries. In Azerbaijan 68 species from 11 genera of thefamily are distributed.

Among the genera, one of the most important is the genus *Rubia* L. There are 3 species in Azerbaijan from the 55-60 species of the genus, which also distributed in Asia, Mediterranean countries, as well as in Africa, South America and Mexico,

Rubia tinctorum L. (=*R. iberica* (Fisch. Ex DC.)

Rubia rigidifolia Pojark. (=*Rubia albocostata* Ehrend.)

Rubia transcaucasica Grossh.

The above species are found in most parts of the country, from low to middle mountain belts, in thickets, along river banks and on arid slopes.

One of the species (*R. rigidifolia*) is a shrub, the others are perennial grasses.

From ancient times the art of carpet weaving has developed in Azerbaijan, including Karabakh. As the city of Shusha, founded in the 18th century, developed rapidly, many technological norms were improved. The methods of dyeing wool used for carpet weaving were studied separately. The process of dyeing in carpet weaving was not a simple process. Thus, the processes of dyeing are carried out together. In this case, more complex chemical processes take place. The chemical aspects of these processes have not been elucidated for many years.

Plants also played an important role in obtaining the colour of the dye. Different plants have been used to produce the dye. *Rubia tinctorum* is one of the plants that allows to obtain dark red dye. Given its importance, in the Caucasus (Dagestan, Karabakh), it was widely cultivated and the above-ground organs of the plant were used to obtain colour. When these parts of the plant were mixed with yellow, it was possible to obtain bright red colours, called "cranberry-red". In this respect it is considered a very useful plant. The species *Rubia transcaucasica* is also a valuabledye.

M.A. Gasymov, one of our scientists involved in dyeing, had great merit. All other fieldsof folk art should be widely explored and their richness should be revealed.

FLORA OF THE MUD VOLCANOES DASHGIL AND KICHIK MARAZA (AZERBAIJAN)

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The vegetation cover of the mud volcanoes of Azerbaijan has not studied yet. For the firsttime was studied the vegetation cover of mud volcanoes Kichik Maraza and Dashgil. The study ofthe adjacent territories flora to the mud volcanoes was carried out in the summer-autumn of 2017-2021 in 2 regions of Azerbaijan. In Gobustan, the mud volcano is located 80 km west of Baku (Kichik Maraza, 677 m a.s.l.) and in Garadagh is located 58 km southwest of Baku and 2.3 km north of the Alyat railway station (Dashgil, 120 m a.s.l.). In both surveyed territories, mainly predominates semi-desert vegetation. As a result of our studies, it was found that the flora of the adjacent territory to the mud volcanoes Kichik Maraza and Dashgil is characterized by a rather low species composition (36 and 11 species, respectively).

The collected floristic material was identified according to the "Flora of Azerbaijan" and and herbarium samples, including analysis of herbarium specimens deposited at the BAK. In addition, The Euro+Med Plant Base was used for the identification of species. Their general taxonomic composition includes 38 species from 36 genera and 17 families (*Amaranthaceae* Juss., *Amaryllidaceae* J.St.-Hil., *Boraginaceae* Juss., *Asparagaceae* Juss., *Brassicaceae* Burnett, *Berberidaceae* Juss., *Compositae* Adans., *Geraniaceae* Juss., *Leguminosae* Juss., *Liliaceae* Juss., *Orobanchaceae* Vent., *Plantaginaceae* Juss., *Plumbaginaceae* Juss., *Poaceae* Barnhart., *Primulaceae* Batsch ex Borkh., *Ranunculaceae* Juss., *Tamaricaceae* Link.). The largest number of species is the families *Amaranthaceae* Juss. (6 species), *Poaceae* Barnhart (6 species) and *Brassicaceae* (5 species). Thus, species distributing on the adjacent territory to Kichik Maraza mud volcano belong to 16 families, of which *Amaranthaceae* (*Climacoptera crassa*, *Petrosimonia brachiata, Salsola dendroides*, *Salsola nodulosa*, *Suaeda microphylla*, *Halocnemum strobilaceum*) and *Poaceae* Barnhart (*Aeluropus littoralis, Agropyron cristatum, Avena eriantha, Poa bulbosa*, *Puccinellia dolicholepis*) include the largest number of species (17% and 14% of the total number of species, respectively). A significantly few numbers of species - 4 are represented in the family Compositae (*Artemisia alpina, Calendula arvensis, Anthemis candidissima, Artemisia fragrans*) and Leguminosae - 8% (*Medicago minima, Trifolium pratense*, *Vicia sativa*). On the territory of the volcano in Alyat was observed distinctive features from previous, where only 11 species were found belonging

to six families (*Amaranthaceae*, *Compositae*, *Plantaginaceae*, *Plumbaginaceae*, *Poaceae*, *Tamaricaceae*). *Amaranthaceae* family is represented by 5 species (*Salsola dendroides*, *Salsola nodulosa*, *Suaeda microphylla*, *Halocnemum strobilaceum*, *Kalidium caspicum*), *Poaceae* only 2 species (*Aeluropus littoralis*, *Bromus japonicus*). Other families by 1 species (9%).

The vegetation cover of the two volcanoes identified within the surveyed area, according to its species composition, varies considerably and the coefficient of their generality (according tothe Jacquard method) is only 24%.

MONITORING PROBLEM IN LICHENS

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For lichenological studies, lichens are of special importance as symbiosis organisms. Lichens belong to the group of weak, growing organisms. Under favorable conditions, their annual growth is1-8 mm. Leafy and bush-like lichens grow faster than crust-like ones. Leafy and bush-like lichens live 30-80 years, some 600 years. Some epilithic lichens live in the mountains of the Arctic for 4.5 thousand years. In this regard, lichens are useful in determining the age of various objects. Determining the age of the substrate surface by means of lichens is one of the most promising directions.

The sensitivity of lichen groupings to different contamination components is not the same. Their reaction to different pollutants is not the same or even uncertain. In this regard, many importantissues arise when studying the lichen groupings. Such species should be selected for a specific urboecosystem that can reflect local changes in the environment.

A comprehensive study of lichens should provide information not only on the lichenoflora of the study area, but also on the local characteristics and biological traits of nearby urboecosystems. On the other hand, a comparative analysis should be conducted on regional backgrounds. Clean background areas such as Goy-Gol National Park and Korchay State Nature Reserve are taken as regional backgrounds. They are used as a source of information to assess anthropogenic transformations in outlying areas. In many cases, the selection of such areas is problematic. In our opinion, these approaches should be adequate to the environmental variability of the urboecosystem we have studied. The degree of pollution of the city highway is interconnected with the spread levelof epiphytic lichens. Maps compiled by means of licenoindication method can be used in designing urban and suburban areas. Among the morphological groups, the main place is occupied by crust-like lichens with 39%, leafy and bush-like lichens with 50-60%.

In the years of research, the decrease in the number of leafy and bush-like lichens is due not only to atmospheric pollution, but also to an increase in anthropogenic impacts.

DISTRIBUTION OF *PHLOMIS* L. AND *EREMOSTACHYS* BUNGE SPECIES IN THE FLORA OF AZERBAIJAN

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The genera *Phlomis* L. and *Eremostachys* Bunge belong to the family *Lamiaceae* which comprises just over 236 genera and approximately 360 to 425 species found all over the World except Antarctica. The 6 species of *Phlomis* and 3 species of *Eremostachys* were treated in the flora of Azerbaijan. Based on morphological evidence, and recent molecular investigations support the inclusion of *Eremostachys* into the *Phlomoides* and accepted as its synonyms. Analysis of approximately 240 specimens of both genera held at the BAK Herbarium Fund indicates that most species of the genus *Phlomis* and *Phlomoides* were collected in different years and the same month, especially in June and July. Still, it is possible to find samples taken in May and August. In contrast to the other two genera (*Phlomis* and *Phlomoides*), herbarium specimens of the genus *Eremostachys* are mainly collected in May and June. The fund also has specimens collected in April, July, August, and September. According to the label data the specimens currently preserved in the fund were collected from different botanical and geographical regions of Azerbaijan.

Phlomis species and allies are found in most areas from lowland to alpine, dry rocky gravelly areas, clayey slopes, xerophilic shrubs, and occasionally river valleys. *Eremostachys macrophylla* Montbret & Aucher ex Benth is accepted as a heterotypic synonym of *Eremostachys molucelloides* Bunge by some authors. These species were collected mainly from Nakhchivan. The representative species of *Eremostachys macrophylla* is a perennial herb that is mainly distributed in the Nakhchivan plains and highlands, low mountains, dry gravel, loamy, stony slopes and rocks, and riverbanks. Species of *Phlomis orientalis* Mill. is found in rocky and stony slopes, and phrygana vegetation. *Eremostachys laciniata* (L.) Bunge was collected in most administrative regions of Azerbaijan. These species are perennials or tuberous geophytes that grow mainly in temperate zones. They are found on the dry, stony slopes of the highlands, the Nakhchivan Plain, and the low mountain belt. Since the species *E. iberica* Vis. are accepted as heterotypic synonyms, data on collection areas are summarized under the species of *E. laciniata* (L.) Bunge. *Phlomis pungens* Willd. and *P. tuberosa* L. (homotypic synonym with *Phlomoides tuberosa* (L.) Moench) species mainly cover the mountainous regions of our republic. The species of *Phlomis pungens* Willd. distributed in the southeast of Guba massif mountain, east of Greater Caucasus, Gobustan, desert highlands, Kur plain,

north, central, and south of Lesser Caucasus, Nakhchivan, and Lankaran highlands, in the Diabar (Zuvand) zone, on dry stonyand clayey slopes, rocks, cliffs, among xerophilic shrubs in gardens and dry riverbeds; the species of *Phlomis tuberosa* L.that are perennial or tuberous geophytic plants and widespread in all parts of Azerbaijan, in the lower and middle mountain zones, on dry clayey and rocky slopes, among xerophilic shrubs, in meadows, gardens, occasionally on the edge of crops.

Based on literatures, rare and endemic species of *Phlomis* L. and allies found in the flora of Azerbaijan were analyzed and only one species – *Phlomis lenkoranica* Knorring was included in bothII and III editions of the Red Book of the Republic of Azerbaijan.

DISTRIBUTION MAP OF *GAGEA* SALISB. (*LILIACEAE*) SPECIES IN THE FLORA OF HISOR STATE NATURE RESERVE

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Hisar state reserve is located in Yakkabog and Shahrisabz districts of the Kashkadarya region. According to the botanical-geographical zoning system of Uzbekistan, it is located in the Kashkadarya region in the western part of the Hisor ridge. Currently, there are more than 1000 speciesin the flora of the area. In the 20th century, the flora of the Kashkadarya region was studied by several scientists, and scientific works were also published. In 2011–2012, Aramov listed 870–910 species of 384 genera belonging to 81 families in the Hisar Nature Reserve, of which 36 species are included in the Red Book. More than 200 species of flowering plants were collected during the study of the flora of the area in 2018–2022. Species of flora in the reserve have not yet been published.

More than 300 species of *Gagea*, which is one of the genera belonging to the polymorphic Liliaceae family and is widespread in the flora of the area, are currently known in the world. As a result of herbarium specimens (LE, MW, SamDU, P, and AA) and field research conducted by the Institute of Botany in 1913–2023, it was determined that the number of species in the territory of Uzbekistan is 75. It became known that 10 species were distributed in the Hisar State Reserve: *Gagea chomutovae* (Pascher) Pascher, *G. delicatula* Vved., *G. dschungarica* Regel, *G. emarginata* Kar. et Kir., *G. graminifolia* Vved., *G. gymnopoda* Vved., *G. hissarica* Lipsky, *G. minutiflora* Regel, *G. ova* Stapf, and *G. stipitata* Merckl.

As a result of determining the coordinates of the places where these species were collected, Geoinformation 5x5 grid system maps were created that reflect their distribution (GIS) (Fig.). This is of great importance for the protection of biological diversity and its monitoring.

Until now, despite the fact that a lot of research has been carried out in the reserve, no targeted floristic research has been carried out, so it is necessary to study the flora of the area. According to the information presented in the literature and the research conducted in the areas adjacent to this region, this region is rich in endemic and rare species.

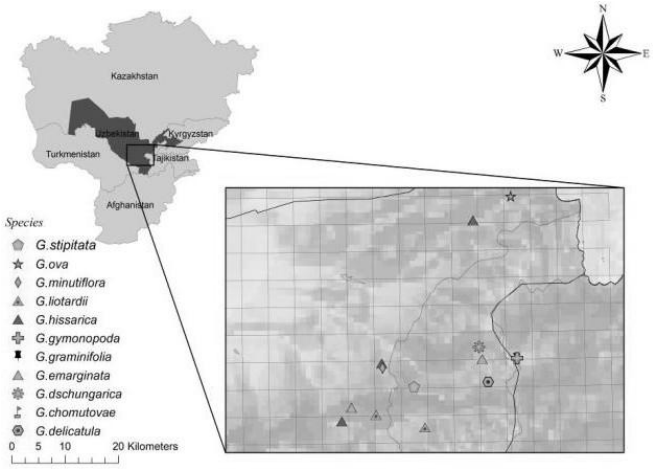

Figure. Species of the genus *Gagea* in the Hisar Nature Reserve

In order to carry out targeted research on the territory and study rare and endemic species, work is being carried out to determine the floristic composition of the reserve in cooperation with the scientific staff of the reserve and the scientists ofthe Institute of Botany of the Academy of Sciences.

NATIONAL PARKS AND RESERVES, RARE AND ENDANGERED PLANTS

PROTECTION OF BIODIVERSITY IN ABSHERON NATIONAL PARK

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The study of the phytocenological structure and floristic composition of the vegetation of the Absheron National Park, which was created on an area of 783 ha in the territory of the Khazar district of the Absheron Peninsula is of great importance for the protection of the environment, rational use, protection of rare and endangered species, the development of ecotourism and recreation areas.

As a result of the conducted scientific research, the modern classification of vegetation was given and their electronic ecological-geobotanical map was compiled.

Absheron National Park was established on the basis of the Absheron State Nature Reserve in the area of 783 hectares of the Khazar district of the Absheron peninsula in 2005. The main purpose of creating the National Park is to ensure environmental protection, rational use, preservation of rare and endangered plants, development of ecotourism, organization of tourism and recreation areas, and ecological awareness.

At the same time, geobotanical research in the phytocenoses of Absheron National Park for the purpose of development of measures for the protection of vegetation is of great relevance as stated in the "Action Plan" for the implementation of the "State Program on the development of the cadastre system of real estate in the Republic of Azerbaijan, increasing the efficiency of land use and its protection for 2016-2020".

Geobotanical studies of psammophyte-desert vegetation formed in the biogeocoenosis or ecosystem of the relevant National Park located in the Shahdili and Suiti cape part of the Caspian Sea on the Absheron Peninsula were carried out by the "route" method in May-June 2021-2022.

As can be seen from the classification of Caspian coastal vegetation developed by us for the first time, two formation classes, four formation groups and six associations were in the psammophyte-desert vegetation formed in the territory of Absheron National Park.

Due to the intensification of negative anthropogenic and technogenic effects on the seaside psammophyte-desert vegetation of Absheron National Park, the species composition of the phytocenosis was depleted, its structure became sparse and a second vegetation cover was formed in the area. Therefore, psammophytes spread quite sparsely in the blown sandy areas.

We recommend the implementation of the following comprehensive protection measures in order to prevent the environmental hazards caused by

wind erosion and degradation of vegetation that may occur on the coast of the Caspian Sea in the territory of the National Park:

– to create a forest strip by using psammophyte species such as Caspian willow (*Salix caspica*), Russian olive (*Elaeagnus angustifolia*), saltcedar (*Tamarix ramosissima*), litoral rush (*Juncus littoralis)*, common reed (*Phragmites australis*), virgate wormwood (*Artemisia scoparia*) etc. depending on the degree of salinization of groundwater in strengthening coastal sand dunes (phytomelioration works);

– to conduct regular phytocenological studies in "semi-stationary" conditions by studying the bioecological characteristics of psammophyte plants in the area;

– to establish a buffer zone between the Zira administrative-territorial district on the border of the park, as well as prohibition of cattle grazing, anthropogenic and man-made influence.

– The scientific and practical application of protection measures for the above-mentioned psammophyte-desert vegetation will create the basis for the protection of phytocenoses and purification of the ecosystem of Absheron National Park.

RARE AND ENDANGERED SPECIES OF THE *ROSACEAE* JUSS. FAMILY DISTRIBUTED IN THE FLORA OF NAKHCHIVAN AUTONOMOUS REPUBLIC

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Based on the results of multi-year research studies conducted during 2004-2021 years and literature data, it was determined that 3021 species of high-spores, gymnosperm and angiosperm plants, grouped into 160 families and 910 genera were identified in the flora of the Nakhchivan Autonomous Republic, of these, 160 species belonging to 30 genera are distributed in the rose family (*Rosaceae* Juss.).

In recent times, as a result of drastic changes in environmental conditions and the influence of anthropogenic factors in the territory of the Autonomous Republic, along with other plants in nature, a number of valuable species that make up the gene pool of this family, are in danger of extinction.

As a result of the analysis, taking into account that 34 species belonging to 11 genera belonging to the rose family (*Rosaceae* Juss.) are rare and endangered, their distribution zones were specified, maps were drawn up, reasons for their extinction were clarified and their protection status was determined.

Ways of protection and restoration of rare and endangered species are defined according to IUCN "Red Data Book" categories, Red Book of Azerbaijan and Nakhchivan Autonomous Republic.

As a result of the research, it became clear that 19 species - *Amelanchier ovalis* Medik. (VU B1a(i)c(ii);C2a(i)), *Cotoneaster integerrimus* Medik. (VU B1a(i)c(ii);C2a(i)), *Crataegus orientalis* Pall. ex Bieb. (NT), *C. pontica* C.Koch (NT), *Padellus mahaleb* (L.) Vass. (LR), *Pyrus medvedevii* Rubtz. (NT), *P. megrica* Gladkova (VU B1a(i)c(ii); C2a(i)), *P. raddeana* Woronow (VU B1a(i)c(ii); C2a(i)), *P. syriaca* Boiss. (NT), *P. voronovii* Rubtz. (VU B1a(i)c(ii); C2a(i)), *P. zangezura* Maleev (VU B1a(i)c(ii); C2a(i)), *Rosa foetida bicolor* Herrm. (EN A2acd; B1b(iii, iv)c(ii,iii)), *R. karjaginii* Sosn. (CR A3c; C2a(i)), *R. nisami* Sosn. (EN B2ac(iii)), *R. sosnovskyana* Tamamsch. (VU A2cd; B1b(iii)c(ii)), *R. rapinii* Boiss. et Bal. (VU D1), *R. pimpinellifolia* L. (EN

B2ac(iii)), *R. tuschetica* Boiss. (VU B1b(iii,iv)c(ii)), *Rubus ibericus* Juz. (NT) were included in the Red Book of Nakhchivan Autonomous Republic, 22 species - *Rosa azerbaidzhanica* Novopokr. & Rzazade (EN B1ab(i,iii)+ 2b(ii,iii,v)), *R. karjaginii* Sosn. (NT), *R. nisami* Sosn. (NT), *R. rapinii* Boiss. & Balansa (VU D1), *R. sosnovskyi* Chrshan. (EN B2ab(ii,iii,iv,v)), *R. zangezura* P.Jar. (VU B1ab(ii)+ 2ab(ii,iii,iv)), *Potentilla agrimonioides* M.Bieb.(NT), *P. crantzii* (Crantz) Fritsch (NT), *Geum rivale* L. (VU B2ab(ii,iii,v)), *Sorbus persica* Hedl. (VU B1ab(ii,iii)+2ab(iii)), *S. roopiana* Bordz. *(*CR B2b(ii,iii)), *S. subfusca* Boiss. (VU D2), *Pyrus georgica* Kuthath. (NT), *P. medvedevii* Rubtz. (NT), *P. raddeana* Woronow (VU B1ac(ii); C2a(i)), *P. salicifolia* Balb. (NT), *P. voronovii* Rubtz. (VU B1ac(ii); C2a(i)), *Cotoneaster saxatilis* Pojark. (VU D2), *Crataegus pontica* K.Koch (EN A1abc; B2ab(i,ii)), *Prunus microcarpa* C.A.Mey. [= *Cerasus microcarpa* (C.A.Mey.) K.Koch] (VU B1ab(i,iii)), *P. nachichevanica* Kudr. (NT), *P. padus* L. [= *Padus avium* Mill.] (EN B2b(ii,iii,v)) - III edition of the Red Book of the Republic of Azerbaijan.

It has been determined that the primary reason for species extinction is the combined effect of climate factors and anthropogenic factors. For this, distribution areas should be under special control and natural populations be protected. It is necessary to increase the attention to the support of natural regeneration and the protection of existing trees.

THE DISTRIBUTION LAWS OF THE SPECIES OF *ORNITHOGALUM REFRACTUM* KIT EX SCHLTDL. WHICH IS FOUND IN THE VICINITY OF MARALGOL, HIGH MOUNTAIN SLOPES

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Ornithogalum refractum Kit ex Schltdl (broken bird species) is an early spring ornamental plant of natural flora. It belongs to the genus *Ornithogalum* L. of the family *Asparagaceae*. The genus *Ornithogalum* is considered a different genus by different authors due to its classic morphological and karyological characters. It is a perennial ephemeroid, rosette geophyte, quite adapted to the environment in the regions of South, Western Europe, Asia Minor. It belongs to the Mediterrian sea areal type. It is found naturally on steppe slopes and bushes at an altitude of 1800-2200 m a.s. l..

Researches were conducted on the grassy slopes around Maralgol, mainly using botanical principles. Maralgol is one of the mountain lakes of Azerbaijan. It is located near Goygol. *O. refractum* formed individual populations in various parts around the lake, in the forest massif above the dam, and in groups on the grassy mountain slopes. Since its population is weak in the upper forest massif, the species has been recorded in 3-4 places. The variation occurring in the population depends on the environmental conditions of growth, i.e. the temperature factor, as well as the biological age of adult generative individuals (Fig. 1).

The appearance of the plant is described by us. Its height does not exceed 10 cm. The root is bulbous, the leaves are narrow, 3-5 mm wide, and the lower part has a white stripe in the middle. It has a smooth leaf edge. Its leaves are up to three times larger than its flowers. Measurements of leaves and flowers were made during the period of mass flowering and parameters were determined. The flowers are white, 6-petalled, actinomorphic. It blooms in the first week of April. Fruits are dry boxes.

The morphological structure of *O. refractum* can change according to the climate. At this time, morphological characteristics of both vegetative and generative spheres of the species are characterized by wide variability. In general, the vegetative sphere is more plastic, especially in the structure and size of the leaf.

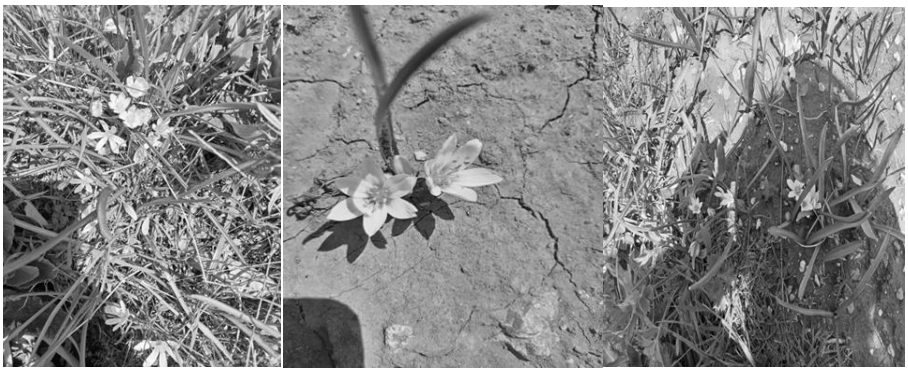

Figure 1. *Ornithogalum refractum* Kit ex Schltdl

The surface development of the species occurs in the most favorable period of the year in terms of humidity. The unstable regime of air and soil temperature in spring, the main limiting factors for vegetation, especially in March and early April, is distinguished by its mosaic due to different degrees of illumination during the day. It is a light-loving mesophytic plant. The phenotypic variability of *O. refractum* is related to its adaptation to an unstable environment.

We identified all available locations of *Ornithogalum refractum* around Maralgöl. We observed that vegetative regeneration and species formation in the soil is weak. A decrease was observed due to the destruction of growing species. According to the IUCN, expanding the network of the species, controlling the population and protecting it from anthropogenic influences are the most important conditions for implementing special conservation measures.

RARE AND ENDANGERED PLANTS OF RELICT MOUNTAIN KULDZHUKTAU (KYZYLKUM, UZBEKISTAN)

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In recent years, as a result of the influence of biotic and abiotic factors on biodiversity, in order to strengthen the protection of rare elements of nature, much attention has been paid to expanding the areas of specially protected natural territories. In world practice, protected natural territories account for 10-11% of the total area of states. To add a certain area to the network of specially protected areas, the presence of some endemic species should not be the main reason, but should be an important botanical or zoological territory from the point of view of endemism. The research was conducted in 2012-2012 in Southwestern Kyzylkum (Kuldzhuktau). The remnant mountains of Kyzylkum are the western link of the central belt of mountain structures of Central Asia and, thus, occupy a special position in the system of Central Asian mountains.

Kuldzhuktau is the southern ridge of the Paleozoic uplands Kyzylkum (Uzbekistan). Kuldzhuktau is located on the territory of Navoi and Bukhara regions of the republic. Length – about 100 km, width – up to 15 km, height – up to 785.6 m above sea level (Koshoshik is the north-western part of the ridge). In the northern and western parts of the mountain are located Guzhumtau and Beltau, which together form the Kuldzhuktau mountain system.

In this remnant mountain, except for 2 narrow-localised endemics (*Astragalus kuldjuktauensis, A. adylovii*) and subendemics of *Onobrychis taevernifolia* (except Uzbekistan grows in Iran) the following plants grow in the Red Book of Uzbekistan: species of *Lepidium subcordatum, Ferula kyzylkumica, Lagochilus vvedensky, Stipa actauvensis, Silene tomentella, Jurenea psammophyla.*

Astragalus centralis E.Sheld. – Status 2; *Astragalus adylovii* F.O.Khass., Ergashev et Kadyrov – Status 1; *Acanthophyllum cyrtostegium* Vved. – Status 3; *Ferula kyzylkumica* Korovin – Status 3; *Jurinea psammophila* Iljin – Status 3; *Lagochilus vevedenskyi* Kamelin et Zuckerw – Status 3; *Lepidium subcordatum*

Botsch. et Vved. – Status 2; *Onobrychis tavernierifolia* Stocks ex Boisser – Status 1; *Silene tomentella* Schischk. – Status 2; *Stipa aktauensis* Roshev. – Status 2; *Tulipa lehmaniana* Mercklin – Status 3.

T. borszczowii is one of the rare species of the genus *Tulipa* L. in Uzbekistan. It was believed that it is so rare in Uzbekistan that in some sources it is cited as endemic to Kazakhstan. However, in the National Herbarium of the Institute Botany Academy of Sciences of the Republic of Uzbekistan (TASH) an herbarium specimen of the species collected in 1965 is kept. It was assembled in the Southeastern part Kyzylkum in the vicinity of the Chardara reservoir. According to A.A. Ivashchenko, the main range of *T. borszczowii* covers the southern regions of Kazakhstan (northern Kyzylkum and the Aral Sea deserts, border areas with Uzbekistan).

During the research, 3 new locations of *T. borszczowii* were found in the vicinity of Kuldzhuktau. We propose to include in the next edition of the Red Book of the Republic of Uzbekistan under 1 status.

The presence of one of the rare relict species of *Rhamnus sentinisii* in the eastern part of Kuldzhuktau (40-50 individuals in total), the presence of a subendemic requiring constant monitoring of *Eremurus korolkovii*, *Tulipa sogdiana* and *Tulipa buhseana* not included in the latest editions of the Red Book, which confirms the importance of this territory from a botanical point of view.

PREDICTION OF THE POTENTIAL DISTRIBUTION OF ENDEMIC SPECIES DISTRIBUTED IN THE FLORA OF UZBEKISTAN USING MAXENT MODELING SOFTWARE

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In the era of globalization, climate change is a major threat affecting the decline of plant species and the integrity of ecosystems worldwide. Warming of the climate compared to the norm can lead to a change in the range of natural species, especially endemic species that cannot adapt to geographically limited climatic conditions and are at risk of extinction. Many endemic plant species are listed by the IUCN as threatened with global extinction due to their narrow geographic distribution and limited habitat. Worldwide, there are more than 70 species belonging to the subgenus *Scorpiris*, most of which (75%) are described from Central Asia and South Asia. Another part is distributed around Southwest Asia and the Mediterranean Sea. The species *I. hippoliyti*, *I. pseudocapnoides*, *I. victoris*, and *I. austrotschatkalica* are found in geographically limited areas of the flora of Uzbekistan. To study the effects of climate change, we selected endemic species of the *Scorpiris* subfamily growing in the territory of Uzbekistan in the western Tien Shan and western Pamir-Alai mountain ranges. To our knowledge, no previous studies have been conducted to resolve the ecological niche for these four species of the subgenus *Scorpiris*. Accordingly, studying its spatial and geographic distribution and relative persistence to estimate its habitat suitability is essential for the conservation of this plant species. Two climate scenarios, RCP2.6 and RCP8.5 for 2050 (mean 2041–2060) and 1970–2000 for 2050 (mean 2041–2060), were developed by the Community Climate Model Systems (CCSM) version 4 of the Integrated Model Intercomparison Project 5 (CMIP5) bioclimatic variables at 2.5 min spatial resolution (this is about 4.5 km at the equator) in the January 2020 version from https://worldclim.org in zip file format containing GeoTiff (.tif) files.Downloaded "tiff" format files were converted to ASCII format for processing in MaxEnt 3.4.4 by the "Raster to ASCII" command in ArcGis 10.6.1.

Our results showed that in the current climatic conditions, the optimal climatic conditions for the endemic species of the subgenus *Scorpiris* correspond to mountainous and sub-mountainous regions. The distribution of taxa is strongly influenced by precipitation and altitude factors. MaxEnt's predictions for 2050 revealed that the geographic distribution of *Scorpiris* species will decrease under future conditions. The predicted models of these

species show a 1500 m loss in places lower than 2000–2500 m and a change in the distribution range of the species population towards the higher elevations. We may see badlands rates increase by 2050, but as species populations push upward and northeastward, these species may not adapt to new environments and struggle for survival as expected.

In order to reduce the risk of extinction in the wild, *ex situ* and *in situ* conservation measures should be taken for *Scorpiris* species. In particular, strengthening of existing populations in the wild as well as assistance programs should be planned. These activities should be accompanied by public awareness and political activities to reduce human-related impacts

DEVELOPMENT OF AN EFFICIENT in vitro CALLUS PROLIFERATION PROTOCOL FOR ENDANGERED MEDICINAL PLANT (*Ferula tadshikorum* Pimenov)

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The aim of the present study was to improve the callus proliferation protocol for *F. tadshikorum* under in vitro conditions. *Ferula tadshikorum* Pimenov is a perennial monocarpic species, a large life cycle is carried out in 23-27 (30) years. As part of medicinal preparations, the plant exhibits expectorant and anticonvulsant properties in exudative diathesis, pulmonary tuberculosis, otitis, lymphadenitis.

The genus *Ferula* L. (Apiaceae Lindl.) includes about 200 species of flowering plants of the Apiaceae family Lindl; many of which are medicinal, food, fodder, honey-bearing, plants containing essential oil and resin. There are 114 species in Central Asia, about 60 in Uzbekistan, of which 5 are endemic. Species of the genus Ferula, mainly mountain plants, are found relatively high – at a level from 300 to 3600 m above sea level, both on fine-grained, variegated layers, and on gravelly slopes, scree and pebbles. A large number of ferula species secrete gum resin, which is considered a valuable medicinal product in India, Pakistan, the USA, Sweden, Germany and Portugal. Gum resin obtained from the root of some species of ferula is used as an ingredient in more than a hundred traditional recipes of oriental medicine. In recent years, our country has begun to produce resins from the roots of *Ferula foetida* (Bunge) Regel and *Ferula tadshikorum* Pimenov, which are exported from the Republic annually in the amount of over 400 tons. Over the past two decades, most natural populations in Uzbekistan have been subjected to increased exploitation due to the collection of gum (resin) from underground organs, mainly from virginal individuals. As a result, many plants, having not reached the generative stage of development, were exhausted and lost their viability. Due to the lack of seed replenishment, natural populations of the valuable medicinal plant *F. tadshikorum* are currently on the verge of complete extinction. *In vitro* microclonal reproduction protocols have been developed for some high-value medicinal ferule species, for example, F. ferulaeoides (Steud.) Korov., F. assa-foetida L., F. gummosa Boiss., F. jaeschkeana Vatke, F. orientalis L. and Ferula sinkiangensis K. M. Shen. To date, there are no reports of reproduction of *F. tadshikorum in vitro.* These species are vulnerable or threatened with extinction due to low seed germination, the duration of the dormant period of seeds, poor regeneration in nature, overexploitation by humans, as well as the lack of

organized cultivation, limited geographical range, etc. These factors lead to the threat of extinction of the listed species.

For callus induction, hypocotyl and root explants taken from 14-20-day old plantlets germinated in Murashige and Skoog (MS) media were cultured in MS media with 27 plant growth regulator (PGR) combinations containing 2,4-Dichlorophenoxyacetic acid (2,4-D) (0.5, 1, and 2 mg/L), 6-benzylaminopurine (BAP) (0.5, 1, and 2 mg/L), Kinetin (Kin) (0.5, 1, 2, 3, and 4 mg/L), naphthylacetic acid (NAA) (0.5, 1, 2, 3, and 4 mg/L). Murashige and Skoog (MS) medium with 2 mg/l NAA and 0,5 mg/l Kin; 0,5 mg/l 2,4-D and 0,5 mg/l Kin; 2.0 mg/l 2,4-D and 1.0 mg/l Kin; 1.0 mg/l NAA and 2.0 mg/l BAP was most effective (90%) for the proliferation of callus for root explants.

RARE SPECIES, *SCILLA MISCHTSCHENKOANA* GROSSH. OF THE FLORA OF NAKHCHIVAN AUTONOMOUS REPUBLIC

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Out of 50 species of the genus bluebell (*Scilla* L.) distributed in the plains and mountain meadows of Europe, Asia and Africa, 17 species are found in Russia and the CIS countries, 13 in the Caucasus, 7 in Azerbaijan, and 3 in the Nakhchivan Autonomous Republic. They are distributed in forests, thickets, sometimes on dry grassy slopes from the middle mountain belt to the alpine in gravelly, clayey and stony places.

Miscttschenko bluebell is a perennial herb 6-12 (15) cm tall. Bulbs are egg-shaped, 1.5-2 cm in diameter, covered with yellowish-gray dry scales.

The stem is weak and bent. The flower-bearing stems are 1-3, branched, cylindrical, thin, leafless and reddish.

Leaves appear at the same time as the flowers, are on the ground, 2-4 in number, vary from broad linear to inverted lanceolate and top arched curved. The flowers are wide bell-shaped, bending, light blue or pale blue, almost white. There are 2-6 flowers, pointed, oblong-elliptical. The petals of the envelope are 1.5 cm long, oblong-elliptic and obtuse. It blooms in April and produces seeds in June. Propagation is by seeds and bulbs. Flowering period is 15-20 days. It is included in the Atropatan geographical range type.

It is common on the grassy slopes of the high mountain belt, in meadows, near melting snow, in old beds and thickets. It is a psychrophyte (plants with low thermophilic) plant. Mesoxerophyte. Ornamental plant. *It is distributed only in Nakhchivan Autonomous Republic in Azerbaijan. It is common in Dumandagh, Nahajir, Lekedagh of Julfa district, Kecheldagh, Ganli gol, Salvarti of Shahbuz district, Nasirvaz, Gamigaya and Gapijig mountains of Ordubad district, gravelly, clayey, dry grassy slopes and stony places.*.

In some areas, the species has completely disappeared or its populations are already in danger of extinction. During the conducted field studies, it was determined that the number of populations of the species has decreased over the last 25 years. Due to the limited distribution areas and population numbers, it

has few natural resources. Their numbers in forest clearings are already in a critical situation, especially in places close to habitats, they have completely disappeared or are at a minimum level. Relatively numerical dynamics are moderate only in high mountain belts.

The factors that influence the decline of the species are its massive collection as an ornamental and vegetable plant, its narrow ecological adaptability, its small population, grazing, fires, and the effects of biotic and abiotic factors. Development of special measures for the protection of their distribution areas and natural populations, strengthening control in distribution areas in order to reduce the anthropogenic impact, and storing the seeds in the seed bank are among the main measures. The main distribution areas of species are specially protected nature areas.

Miscttschenko bluebell is included in the newly published III edition of the "Red Book of the Republic of Azerbaijan". The plant is cultivated in the Botanical Garden of the Institute of Bioresources (Nakhchivan) of the Ministry of Science and Education of Azerbaijan.

DENDROLOGICAL AND DENDROCHRONOLOGICAL INVESTIGATION OF HIRKAN NATIONAL PARK OF THE REPUBLIC OF AZERBAIJAN

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The Hirkan National Park of the MENR of the Republic of Azerbaijan is located in the southern part of the Caucasus, and in the southeastern part of Azerbaijan, in the territory of Lankaran-Astara administrative regions.

In order to determine the edificator species that dominate the forest ecosystems of the Hirkan flora, scientific missions were organized to the Hirkan National Park, which is the nature museum of the Republic of Azerbaijan, observations, dendrochronological studies were conducted in the area, and samples were taken from old specimens. Without in-depth study of the structure and development dynamics of the forest, the inefficient use of natural resources leads to the decline of the forest ecosystem and the loss of biological diversity. Possibilities of increasing tree species that meet predetermined qualities create conditions for effective use of firewood. For this reason, we have dedicated the research work to the dendrochronological study of the species Georgian oak - *Quercus iberica* M.Bieb, European hornbeam - *Caprinus betulus* L., sweet chestnut - *Castanea sativa* Mill., black walnut - *Juglans nigra* L., Caucasian alder - *Alnus subcordata* C.A.Mey.

As a result of the monitoring in the Hirkan National Park, it was observed the thinning of *Parrotia* C.A.Mey. species at an altitude of 500-600 m above sea level, and that the main components of the lower tier are species *Quercus castaneifolia* C.A.Mey and *Carpinus caucasica*. In addition, various species belonging to the genus *Pterocarya* Kunth, *Alnus subcordata* C.A.Mey, *Alnus barbata* C.A.Mey and singly *Ulmus* L.were also found in the areas.

Based on modern equipment and the TSAPwin program, the average and annual indicators of the main climatic factors affecting the species were studied in the research work, the data of the central meteorological stations and the indicators of the species were comparatively analyzed, substantiated and diagrams were constructed.

Ecosystems were assessed during the study, dendrochronological analysis of old and rare species was carried out and future predictions were made for these species.

Despite the fact that the area belongs to the ancient relic period, as a result of research, it was found that the average age of the trees here reaches 120-350 years. As a result of the well-known events of the 90s, lack of energy, the influence of anthropogenic and other factors, many plant species were threatened with extinction and their ranges were reduced.

As a result of research, it was determined that the age of the *Quercus castaneifolia* C.A.Mey species with a trunk diameter of 262 cm is 125 years. Based on the obtained graphic results, it was determined that the species showed high development dynamics in 1900, 1940, 1951, 1963 and 2010. The highest rate was observed at the age of 54 and 60 years of the species. In 1918, 1921, 1952, 1978 and 2013, the development was weakened, the lowest development dynamics were observed at the age of 66, 112 and 122 years, and the species was recognized as endangered.

Different results were obtained in other *Quercus castaneifolia* C.A.Mey species taken from Hirkan flora. It was determined that the species with a diameter of 125 cm is 50 years old. The development indicators in this species are as follows: In 1978, 2004, 2012, the wide of the inter-ring distance was observed in the species, the highest radial growth was observed at 34 and 42 years of age. In 1983, 1998, 2013, 2015, 2017, the development weakened, the lowest development dynamics was determined in 2009, 2016, at the age of 28, 48.

In the studied species, the age of the plants was determined based on the number of annual rings based on the application of dendrochronological methods. In the studied species, it was observed that the radial growth is more intense during maturity period, and the radial growth weakens with increasing age.

During the comparative analysis, it was observed that the radial growth was at its minimum in 2010 and 2015, and at its maximum in 1973 and 1985.

NEW RARE ALGAE SPECIES OF THE CASPIAN SEA

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The geographical location, relief, and unique flora of the Caspian Sea are distinguished by their richness and variety. In terms of biodiversity in the seas, algae are of great importance as they are one of the primary producers of the marine environment. The continuous increase of anthropogenic factors, as well as the sharp change in environmental conditions, has led to the narrowing of the range of many species of algae, some of which are threatened by extinction and disappearance. Biodiversity is declining dramatically, with millions of species now threatened with extinction, so species conservation is critical worldwide. For this reason, environmental monitoring is carried out due to the preservation of the algal flora of the Caspian Sea, the study and prediction of anthropogenic changes in the environment and biosphere. Increasing industrial pollution along the Caspian Sea coast is dangerous for the marine biota and leads to a decrease in its biodiversity, resulting in the loss of rare species. Systematic research on the Azerbaijani shores of the Caspian Sea has been carried out since the 60s of the last century.

The main goal of our research was to reveal the biodiversity of the algoflora of the coastal areas of the Caspian Sea, study its taxonomic structure, and identify rare and new species. Researches were conducted in May-December, 2022 on the southern shores of the Caspian Sea (Lankaran region), the northeastern coasts (Shabran and Siyazan regions), the settlements and villages of the Absheron peninsula. A scanning electron microscope (JSM-35, Japan) was used to identify diatoms, and an optical microscope (Nikon E100) was used to identify algae of other divisions. The most recent databases (AlgaeBase (Guiry, Guiry, 2022), California Academy, Alga Terra) were used to indicate the names of the designated algae species. According to the research results, nine species belonging to three divisions, six orders, six families, and eight genera were represented. The divisions to which these species belong are: *Chlorophyta* (4 species), *Rhodophyta* (3 species) and *Bacillariophyta* (2 species). Both new and rare species were identified during the research: *Cladophora albida* (Nees) Kützing, *Cladophora ruchingeri* (C.Agardh) Kützing, *Corallina officinalis* J.Ellis Solander, *Jania virgata* (Zanardini) Montagne, *Ulnaria ulna* (Nitzsch) P.Compère, *Navicula halophila* (Grunow) Cleve and rare species-

Colaconema elegans (K.M.Drew) I.-K.Hwang & H.-S.Kim, *Ulva prolifera* O.F.Müller, *Ulva torta* (Mertens) Trevisan. The ecological results of the research showed that new species, both planktonic, benthic and epilithic, were identified for the algoflora of the Caspian Sea - *Cladophora albida* (Nees) Kützing, *Cladophora ruchingeri* (C.Agardh) Kützing rare species *Corallina officinalis* J.Ellis Solander, *Colaconema elegans* (K.M.Drew) I.-K.Hwang & H.-S.Kim, both planktonic and epilithic new species *Ulnaria ulna* (Nitzsch) P.Compère, *Navicula halophila* (Grunow) Cleve, both planktonic and benthic new species *Jania virgata* (Zanardini) Montagne, benthic rare species *Ulva torta* (Mertens) Trevisan, *Ulva prolifera* O.F.Müller. The species is distributed over a temperature range of 11-27^{0}C and pH of 7.3-7.6. Two of the studied species were collected from upper-, four species from supra-, and three species from sublittoral zones.

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ENDEMIC PINK SPECIES DISTRIBUTED IN AZERBAIJAN

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Pink (*Dianthus* L.) is a perennial plant, belongs to the pink family (*Caryophyllaceae*). There are 26 species of the genus in the flora of Azerbaijan. Three of these species are cultivated (*D. barbatus, D. chinensis, D.caryophyllus*) and are considered decorative plants. In many parts of the world, in Africa, Asia, North America, Mediterranean countries, species of the genus are more common. They are mainly planted as decorative plants. Some species such as Amur pink (*D. amurensis* Jacq.), Chinese pink (*D. chinensis* L.), oriental pink (*D. orientalis* Adam) and others are used as medicinal plants in Azerbaijan. Among the pinks distributed in Azerbaijan, the pinks mentioned below are endemic species of the Caucasus. In recent years, a number of changes that have occurred in world science, based on the results of molecular analysis, we accept the taxa that have undergone nomenclature changes as they are. Thus, the changes related to the transition of some endemic species to subendemics or synonyms of other species were taken into account.

- *D. raddeanus* Vierh.
- *D. ruprechtii* Schischk.
- *D. kusnezowii* Marcow.
- *D. fragrans M.Bieb.*
- *D. inamoenus* Schischk.
- *D.schemachensis* Schishk. Only one species is endemic to Azerbaijan.
- *D. capitatus* DC =*D. subulosus* Conrath & Freyn
- D. marschallii Schischk=D.bicolor.

Pinks are distributed on grassy slopes, meadows, stony gravel areas from plain to mid-mountain belt, from subalpine to alpine. They are widely used as decorative plants in parks, gardens, and lawns.

Ruprekht pink *(D.ruprechtii* Schishk) 1930, in Grossh. Fl. Caucasus. 2:433. Described from Dagestan. Typus"Caucasus orient., Daqestania australis, versus fontesfluvii Samur, pr. Bashmushash, 1050-1100,14 VII 1860, Ruprecht" (LE!) GC (Guba) Common in meadows in the subalpine zone. Flowering in VI, fruiting in VII-VIII.

Radde pink (*D.raddeanus* Vierh.) 1898, Sitzundsber.Akad.W iss. (Wien), 57,1:1145. Described from Nakhchivan. Common in LC north LC center Nakh. Karab. subalpine belt meadows. Flowering inVI, fruiting in VII.

Kuznetsov pink (***D. kusnezowii Marcow***.) 1923, Bot. mat. (Leningrad), 4:31. Described from Abkhazia.*Typus:* "Klukhor pass, south slope along the road to Teberda, 2 VII 1907, Marcovicz"(LE!,.izotypi-ERE!TBİ!) Common in LC (Guba), alpine belt, on rock and meadow. Flowering in VII, fruiting in VIII.

Fragrant pink (***D. fragrans*** **Adams),** 1805, in Weber u Mohr, Beitr, Naturk.1:56. It was described from the North Caucasus (Pyatigorsk). *Lektotypus* (Kuzmina, 2004 :293) : "Ad aqus asidas Constantinomontanas, Adams"(LE!). Common in LC north (Hajikand), GC (Guba), GC west (Alaz-Ayrich.), Gob. from upper forest belt to subalpine, on dry clay slopes, rocks, grassy slopes, subalpine steppes. Flowering in VI, fruiting in VIII.

Unattractive pink (***D. inamoenus*** **Schischk**.) 1936, Fl. USSR, 6:897, 842. Described from Georgia. *Typus*: "Georqia, Tbilissi (Tbilisi) in deslivitatibus ad fl.Vera,26 V 1918, fl., B.Schischk" (TBİ!) Common in Gob. Absh. Kur. Araz. Bozgir, Diabar, Lank. mount. plain, up to lower and middle mountain belt, dry clayey, stony slopes and bushes. Flowering in IV (V), fruiting in VI (VII).

Shamakhi pink (***D.schemachensis*** **Schishk**.) ,1931, Proced. geobot. surv. of past. Azerb. SSR, ser. A,7:90 ***Typus***:"Transcaucasica, Azerbajdzhan, distr. Schemasha, inter pagos Kushtshy et m. Kalamadyn, 5 V, 1928, fr., M.Sachokia"(LE!). Grows in Caspian coastal plain, Absh. from lowland to middle mountain belt, in dry, clay, stone slopes, rocks, screes, wormwood deserts.

SOME RARE SPECIES OF LANKARAN DISTRICT

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The action plan for the protection of biodiversity places special emphasis on the conservation of rare flora. Protection of rare and endangered species, one of the most sensitive parts of biodiversity, preservation of plant communities are one of the priority issues facing botanists in Azerbaijan at present, and its solution should be implemented at both the global and regional levels. This is confirmed by the organization of Specially Protected Areas in Azerbaijan and the compilation of the Red Book [1989, 2013].

Lankaran territory has a rich vegetation because it includes flora elements of different types of areas from a geographical point of view. The researches were conducted in the seashore, foothills, meadow, wetland, frigana, forest plant-communities of Lankaran, Lerik, Masalli and Astara districts by route and field methods. The diversity of its relief, which consists mainly of plains and some mountainous parts, directly affects the vegetation. Different types of climate conditions are observed in this region, usually north, north-west and south-west winds prevail. The average monthly air temperature is below -3^0C in the coldest month and above +10 in the warmest month. Dry summer, rainy autumn and cold winter months are typical for almost the area.

A total of 31 rare species were recorded in our study area: *Alnus subcordata* C.A.Mey., *Pterocaria pterocarpa* (Michx.) Delchev, *Buxus hyrcana* Pojark., *Taxus baccata* L, *Diospirus lotus* L, *Parrotia persica* (DC.) C.A.Mey., *Zelcova carpinepholia* (Pall.) C.Koch, *Gleditchia caspica* Desf, *Albiziya julibrissin* Durazz., *Quercus castaniefolia* C.A.Mey, *Ficus hyrcana (=F.carica)* L, *Rhus coriaria* L, *Punica granatum* L, *Ruscus hyrcanus* Woronow, *Danae racemosa* (L) Moench., *İlex hyrcana* Pojark., *İris pseudocorus* L, *Orchis purpurea*Huds, *İris musulmanica* Fomin (İ.klattii Kem-Nath.), *Alcea hyrcana* (Grossh.) Grossh. *A. Lenkoranica* İljin. In the distribution areas of the studied species, the influence of strong climate variability (landslides caused by rain) and anthropogenic factors (grazing, mowing) is observed.

Among the recorded plant species, 31 rare species have been recorded, of which 12 are trees, 4 - shrubs, 1 - liana and 14 - grasses according to their life forms. Of these, *Zelcova carpinifolia, Diospurus lotus, Albizia julibrisin* etc. tree species belong to the Arcto-Tertiary period, which have the Hyrkan type. Despite the fact that most of the species are located in the territory of the Hirkan National Park, they tend to decrease both in the territory of the National Park and in the outlying areas. Because these species have been exposed to various

fungal diseases in recent years, and as a result, these diseases damage the fruits of the species and have a negative effect on their reproduction.

Another leading factor is climate change. Drought, heavy rains, resulting soil erosion change the mechanical structure of the substrates where plant species grow, and have a negative effect on their positive development. At present, the coastal ecosystems of Lankaran and Astara districts are under great influence. The construction of recreation centers and the establishment of parks are one of the reasons for the sharp decrease of rare tree species such as *Pterocaria pterocarpa*, *Punica granatum*, *Gleditchia caspia*, *Alnus subcordata*, etc. and grasses such as *Alcea lencoranica*, *Iris pseudocorus*, *Orchis purpurea* growing here.

As a result of research carried out in the national park and other areas of our republic in recent years, rare species with shrinking ranges have been studied, and the assessment of their current condition is reflected in the new 3rd edition of the Red Book of Azerbaijan.

MORPHOMETRIC STRUCTURE OF THE COENOPOPULATIONS OF *IRIS RETICULATA* M. BIEB. IN THE NORTH-EASTERN PART OF THE GREATER CAUCASUS

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One of the most important and urgent issues facing modern botanists and specialists working in the field of plant protection is the study of rare and endangered species in their *in-situ* distribution limits in order to effectively organize their protection.

The object of the research is *Iris reticulata* M. Bieb**.** belonging to the family Iridaceae Juss., included in the 2nd edition of the Red Book of Azerbaijan with the status NT. Field investigations were conducted in the period from 2017 to 2022 in expeditionary, stationary and laboratory conditions. Morphometric analysis was carried out on the basis of 30 randomly selected generative individuals per population. A plant individual was considered as a counting unit.

The morphometric structure of the coenopopulations of *I. reticulata* was studied in the villages of Gedik (CP 1), Isnov (CP 2), Uchkun-Kupchal (CP 3) of Guba region, on grassy slopes at the belt of the mountain in the villages of Altiaghach-Angilan (CP 4) of Khizi region, Chukhuryurd-Nagarakhana (CP 5) village of Shamakhi, Maraza (CP 6) village of Gobustan region.

The comparison of the average values of the morphometric parameters of *I. reticulata* show that individuals with a high value of the leaf length parameter were recorded in CP 5-6 (±12.74-15 cm), and those with a low value were recorded in CP 1 (±8.78 cm). The high value of leaf width morphoparameter was recorded in CP 2 (±0.48 cm). The highest value of the flower shoot length parameter was observed in CP 6 (±8.03 cm), and the lowest value was observed in CP 1 (±2.61 cm). The upper value of the petal length morphoparameter was recorded in CP 6 (±5.54 cm), and its width in CP 2 (±0.98 cm). It was determined that the value of the bulb length morphoparameter was high in CP 2 (±2.12 cm) and CP 5 (±2.11 cm), and the bulb width was high in CP 3 (±1.95 cm). The highest value of morphoparameters of roots length and number of roots was found in CP 5 (respectively, ±7.4 and ±11.4 cm).

The results of the morphometric analysis of *I. reticulata* show that individuals with the highest indicators of morphological parameters were found in coenopopulations in the grassy slopes in the direction of Chukhuryurd-Nagarakhana villages of Shamakhi region and in the planted

forest around Maraza village of Gobustan region. Those areas are located at an altitude of 700-1100 m a.s.l. The soil type of those areas is irrigated gray-brown, alkaline (pH 8.5). The amount of humus is low, it is 1.7%. Also, the nitrogen, C:N ratio in the soil is low. Low indicators of the morphological parameters of individuals of this species were found in ceonopopulations in the cultivated area around the village of Gedik, Guba region. This area is located at an altitude of 248 m a.s.l. The soil type of the area is mountain-gray-brown, and the environment is close to neutral.

Looking at the climate indicators of these areas, it can be seen that in Shamakhi and Gobustan regions, frosty days were observed in the average monthly air temperature in 2017 and 2020. In Guba region, minus temperatures were recorded during 2016-2020. The amount of average monthly rainfall in Shamakhi, Gobustan and Guba regions in 2019-2020 increased sharply compared to previous years. The analysis of the relief, climate and edaphic characteristics of the area shows that individuals of this species mainly prefer areas up to 1000 m a.s.l., alkaline, mostly dry soils.

CLASSIFICATION ON GEOLOGICAL PERIODS AND RED LIST OF RELICT TREE AND SHRUB SPECIES OF OGHUZ AND SHEKI DISTRICTS OF AZERBAIJAN

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The climate was warm and humid during the Paleocene and Eocene stages of the III period of the Cenozoic era. During this period, Poltava flora - mainly evergreen plants - prevailed. From the beginning of the Oligocene stage, the evergreen Poltava flora was replaced by the deciduous Turgai flora. Due to the glaciation from the end of the III period and the beginning of the IV period, the ranges of Turgai flora, widespread from the Oligocene period, begin to shrink.

If the range of a species was very large over time, and if it has decreased over time, it is considered a relict range, and that species as a relict. Relic (lat. *relictum* - remnant) - species of plants or animals that were widespread in the past, but now remain only in a small area, continue to live. The term "relic" was first introduced into the scientific literature by the German geographer and anthropologist Oskar Ferdinand Peschel in 1875.

In the territories of Oghuz and Sheki districts, there are 7 relict tree and shrub species belonging to 7 families and 7 genera left from the subtropical, evergreen Poltava flora. Five of these species are included in the "Red Book of the Republic of Azerbaijan".

As a result of research and analysis, it was considered appropriate to include *Danae rasemosa* (L.) Moench.- Alexandria laurel and *Hedera pastuchovii* Woronow.- Pastukhov ivy species in the relics of the Poltava flora. In the study area there are relict trees and shrubs of 33 species of arctic and deciduous Turgai flora belonging to 16 families, 25 genera.

Of these, 7 species (*Alnus barbata* C.A.- Bearded alder, *Corylus colurna* L.- Turkish hazel, *Castanea sativa* Mill.- sweet chestnut, *Pterocarya pterocarpa* Kunth ex I. Iljinsk.- wingnut, *Fraxinus coriariifolia* Scheele.- sumach ash, *Pinus kochiana* Klotzsch ex K.Koch. (P.hamata (Stev) Sosn)-Kochi pine, *Frangula grandifolia* (Fisch.et Mey.) Grub.- large-leaved buckthorn) were included in the "Red Book of the Republic of Azerbaijan" published in 2013.

Oghuz and Sheki districts can be considered a relic area if we take into account that the soil and climate conditions are favorable for the plant world, its

ecogeographical position, the fact that the Caucasus Mountains block cold air currents from the north, the abundance of rivers and the richness of relict species from the Poltava and Turgai floras.

In the study area, 40 species of trees and shrubs covering 23 families, 32 genera, belonging to their relics are distributed.

THE INFLUENCE OF ANTHOPOGENEOUS FACTORS ON THE COENOPOPULATIONS OF RARE SPECIES *TULIPA* L.

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Protection of coenopopulations of endangered species in natural areas is one of the urgent issues of modern times. The transformation of natural landscapes as a result of human economic activity has a serious impact on the limited number of local populations of rare geophytes. As the anthropogenic effects intensify, the number of individuals in the coenopopulations of the rare species *Tulipa* L. decrease, the ontogenetic structure is disturbed. The increase in grazing load of cattle, recreational effects, soil trampling, destruction of plant groups on the edge of agricultural fields, disruption of phytocenotic relationships, replacement of natural vegetation with second type vegetation in agrocenoses cause the loss of rare species.

In order to evaluate the anthropogenic influence on the continuity of the coenopulations, rare species *T. eichleri* Regel and *T. biebersteiniana* Schult. et Schult regions cenopopulations in Shamakhi, Gobustan and Ismayilli were studied. According to the Red List of the International Union for Conservation of Nature (IUCN), *T. eichleri* and *T. biebersteiniana* species are included in the "Red Book" of Azerbaijan under the category "Endangered" (status VU A2c+3c). Bioecological characteristics and ontogenetic structure of rare species were studied during monitoring in test plots (1 m^2) in untouched natural areas and in agrocenoses where plants spread. Based on multi-year observations, limiting risk factors for localities have been determined.

During nature routes, *T. eichleri* Regel and *T. biebersteiniana* Schult. et Schult species were studied in natural phytocenoses around the villages of Ivanovka, Gushenca, Shamakhi region, Marzandiyya, Arabshalbashi, Charkhan villages, Shahriyar settlement, Ceyirli, Tekla, Bekla, Khilmili, Nabur villages, Gobustan region. Monitoring of individuals at different age stages shows that the development of plants in an undisturbed natural landscape accompanied by dynamic growth, and complete ontogenesis continues with *juvenile, virginal, immature, generative* and *senile* stages (*j-v-im-g-s*). The annual increase in the number of *juvenile* and *generative* individuals increases the sustainability of the coenopopulation. Ontogenetic analysis of *T. eichleri* and *T. biebersteiniana* species in test plots shows that *juvenile* (*j*) and *immature* (*im*) individuals rapidly die out as the impact of agrotechnical measures carried out in cultivated areas increases. On average, 3-5 plants in the generative (g) stage found in the test plots. Researches show that as a result of intense anthopogenic pressure on the

cultivated and pasture lands inhabited by plants in the process of historical evolution, individuals *j, im, v* are destroyed. In coenopopulations where the spectrum is incomplete, a large number of *generative* individuals characterizes the left-sided ontogeny, and development continues with the annual renewal of *generative* individuals by replacement bulbs. The vitality of rare geophytes is an indicator for determining the state of soil conditions. The excessive use of fertilizers and herbicides in cultivated fields has a negative effect on the vegetation on the edge of the field and results in the destruction of individuals in the initial age stage of the ontogenetic spectrum. The loss of *T. eichleri* and *T. biebersteiniana* species that spread on the edge of agricultural areas can be considered as soil and vegetation degradation.

For the *in-situ* protection of rare species *Tulipa* L. localities, it is advisable to place warning signs in agrocenoses, create micro-reserves, buffer zones, carry out genetic certification of plants and monitoring through the GIS system. In the future, using aerospace data, it is possible to create a distant information base, determine the geographical coordinates of each locality using a GPS-navigator, monitor and predict changes in coenopopulations.

ETHNOBOTANY

METHODS OF DRYING MEDICINAL PLANT RAW MATERIALS

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The vast majority of medicinal plant raw materials are used in medicine in dried form. Only certain species (aloe, saffron, kalanchoe) are allowed to be used after preliminary processing. Ensuring the safety of biologically active substances during drying is considered as the simplest andmost effective method of preserving medicinal raw materials. Medicinal plants lose 70-90% moisture during collection, and 10-15(20) % after drying. Biologically active substances are collected in living cells for the first time as a result of biochemical processes. Moisture andviolation of food exchange processes, natural dehydration, causes a decrease in the content of raw materials and biologically active substances. Enzymes are denatured during drying with temperature. If the temperature is maintained, the lysis process begins. However, in some cases, the process of drying raw materials is considered an indication to increase the content of active ingredients. In order to preserve certain groups of biologically active substances during the optimal drying regime, drying should be based on experimental data with the help of special methods. Drying should be done gradually, that is, raw materials should be dried under cover (attic, mansard, etc.) at normal temperature. Sometimes the reagent increases the progress of the procedure or accelerates the subsequent dehydration process. There are various methods currently used fordrying medicinal plants.

Without artificial heat: a) air-shade in open air, under sheds and wind-driven dryers; b) special drying under the open sun - dried by air drying.

With artificial heat or heat: a) leaves, grass and flowers are dried by the shade-air method.In simple cases, raw materials are stored under sheds or in special drying stations. b) the drying chamber with air dryers is equipped with shelves located inside a canvas or metal grid.

High-quality raw materials are obtained by drying with air dryers in the open air very slowly. A hot dry climate mainly causes almost no damage to rhizomes, roots and other underground organs under the influence of solar radiation.

During drying in the sun, the amount of alkaloids and tanning substances in the raw materials decreases to a certain extent (scopolia, groundsel). Therefore, plants containing pigment substances should be dried only in the shade. *With a hot dry climate*, raw materials from different morphological groups are collected and dried under any conditions.

Such drying is called *convective and thermoradiative drying*. *Convective drying* refers to constant and continuous drying in a drying cabinet. During multiple drying, the drying cabinet is constructed as a stationary and portable type. Stationary dryer is usually used for medicinal plants in large stations. Their drying chamber consists of a pot, a metal grid and an insulated drying chamber. Dryers are heated with water, steam or flue gases. *Individual collectors* also use heat drying ovens and hot plates.

Radiation drying is carried out with the help of infrared rays and significantly reduces dehydration processes. This method is used in laboratory conditions.

Tests have proven that the drying efficiency of medicinal plants in microwave ovens is higher. All methods of drying medicinal plant raw materials (except for essential oils) should be spread in a thin layer. In an experimental study, during drying plant shoots loses their weight 65- 70%; flowers - 70-80%; leaves - 55-90%; herbs - 65-90%; roots and rhizomes - 60-80%; shell - 50-70%; the fruit - 30-60% and seed - 20-40%.

GENUS *INULA* L. OF UZBEKISTAN AND TRADITIONAL USE

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Ethnobotanical knowledge is critical for the conservation and utilization of local plants. In recent years, the regular use of local plants and their extensive research have become one of the most important tasks in the world and in our republic. One of the most important aspects of natural plants is that they do not cause side effects in the human body.

Among such species, we can mention the species of the *Inula* L. genus. Representatives of the genus *Inula* L. are widespread in the flora of the world and include about 100 species. In the flora of our republic, six species of the genus have been recorded. Representatives of the genus havebeen regularly used by local residents in folk medicine for several years. In particular, representatives of the local population mainly use *Inula helenium* and *Inula grandis* species on a large scale. The analysis of the information in the literature and the results obtained during the field research show that tinctures prepared from the roots and rhizomes of the plant are regularly consumed by the population.

These species are mainly located in the regions of our republic between 800 and 2100 m above sea level. Representatives of the population living in these areas say that these plants are widely used to prevent cancer and fight against various microbes.

Inula helenium is popularly called black andis, nine powers (used as a cure for ninediseases in folk medicine), and wild sunflower. According to their chemical composition, roots and rhizomes contain up to 44% inulin and pseudoinulin, 1-3% essential oils, carbohydrates, alkaloids, and saponins. Essential oil is a crystalline mass that solidifies quickly, up to 0.16%, and has aunique smell and taste.

Use in folk medicine: In recent years, it has been noted that people use root tinctures of andis for the treatment of joint pain, bone fractures, and decay. For this, the roots and rhizomes of the plant are crushed, and 1 teaspoon is put in 200 ml of water and boiled for 20–25 minutes. Thenit is cooled and drunk 50 ml three times a day, 30 minutes before meals.

It was noted that tinctures are used by local residents for diseases of the upper respiratory tract, headaches, diuretics, diabetes, salt accumulation prevention, antipyretics, dewormers, and wound treatment. In scientific medicine, as a result of the consumption of the tincture of this plant for 20 days, it has been proven by scientists that excess salts in the human body, pain, and

bone erosion can be prevented.

Inula grandis is popularly known as yellow andis and white andis. This species is less popular among the local population compared to *Inula helenium.* According to the chemical composition, the roots, according to the literature, contain 0.01-3% essential oil, 0.063-0.075% alkaloids, 30-40% inulin, and 44.9 mg% vitamin C in the leaves. Use in folk medicine: rhizome androot decoction (10 g–200 ml) is used as an expectorant in inflammatory diseases of the respiratory tract and for the treatment of gastrointestinal diseases. The decoction is drunken 1 tablespoon 20 minutes before meals, 3–4 times a day, as a cough suppressant and expectorant. The use of plant tinctures as diuretics and cold remedies among some mountain residents of the Surkhandarya regionwas noted during research.

Representatives of the genus *Inula* L. are characterized by the fact that they accumulate a lot of biologically active substances. This requires more research and protection of these species of plants. One of our important scientific and social tasks is to identify species regularly used by the local population and to develop such knowledge among the population.

ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS USED IN DIGESTIVE DISORDERS IN AZERBAIJAN

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The Republic of Azerbaijan is one of the richest regions in terms of biology, located in the eastern part of the South Caucasus, in the contact zone between Western Asia and Eastern Europe. The specific location and landscape diversity of the country determines its rich biodiversity. The unique ethnic, religious, linguistic and cultural richness existing in Azerbaijan is also reflected in traditional medicine and folklore. Plants have been used for centuries as nutrition, treatment, medicine, paints, construction materials, agriculture, fuel, and animal feed. In different regions of the country, various denomination of medicinal plants, as well as their preparation and application have been mentioned.

In the present paper, we provide data on medicinal plants used in digestive system disorders. It is recorded that 51% of patients suffering from diseases of the gastrointestinal tract use non- traditional medicines. Moreover, 10% of the alternative treatments are used for treatment of gastrointestinal diseases. The aim of this study is to research the plants used in gastrointestinal diseases in Azerbaijani traditional medicine, to classify by respective diseases, to identify dominant families by the number of species, and to fulfil other statistical analysis. The results will allow to determine perspective of some medicinal plant species for further phytochemical research.

The study has been carried out in 5 geobotanical areas of Azerbaijan: the western part of the Greater Caucasus, the eastern part of the Greater Caucasus, mountainous part of Nakhchivan, Lankaran mountain zone and Diabar. In order to study the medicinal plants used in digestive systemdisorders forty people from each region have been interviewed. Among them 70 respondents (35%) were women and 130 (65%) were men, with the age range between 35-90 years. In total, 131 plant species have been recorded to be used for the treatment of 13 digestive system diseases. Predominance of the representatives of *Asteraceae*, *Lamiaceae* and *Rosaceae* families in terms of the number of plant species was recorded. Herbs, fruits, leaves and flowers were the plant parts most mentioned. It has been found that the majority of the plants are used as infusions and decoctions. According to the living form of the plants mentioned by the respondents, 99 were herbs, 19 - trees, 12 - shrubs and 2 - semi-shrubs. Among them herbs of 48 species, the fruits of 32 sp., the leaves of 23 sp., the flowers of

18 sp., the roots of 13 sp., the seeds of 7 sp., the rhizomes of 7 sp. and the bark of 2 sp. have been recorded.

According to the type of disorder, it was determined that 88 plants were used in acute and chronic gastritis, 100-in gastric ulcer, 30-in disbacteriosis, 77-in haemorrhoid, and 54-against flatulence. 75 respondents reported about the use of medicinal plants in acute and chronic gastritis, 53 in gastric ulcer, 38-in haemorrhoid, 14-in constipation, and 20-in other diseases. Based on the results of the research, the Use Value (UV) and Informant Consensus Factor (ICF) have been calculated related to the medicinal plants.

The results of the present research will serve the purpose of bioresearch and will form a solid basis for the detection of new bioactive molecules and the creation of potential drugs from them.

PERSPECTIVES OF THE USE OF USEFUL SPECIES OF THE *ROSACEAE* JUSS. FAMILY FOUND IN THE FOREST AND SHRUB VEGETATION OF AZERBAIJAN

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Rosaceae Juss. – the rose family which is widespread in the biodiversity of Azerbaijan's flora occupies a unique place, both due to the number of species and useful properties. More than 2500 species of about 100 genera are distributed in the world flora, of which up to 195 species belonging to 29 genera are found in Azerbaijan. It was known that 15 species from the *Crataegus, Rosa, Geum, Fragaria, Rubus, Sanguosorba, Sorbus, Fillipendula, Potentilla, Prunus* and *Cydonia* generas have a wider field of application among the local population.

Its representatives are mainly trees, shrubs, semi-shrubs, subshrubs and grasses. Species of the rose family are considered a valuable source of raw materials because they are rich in biologically active substances, in addition to having a number of useful properties such as feed, dye, medicine, food. Discovering new ways of using species with such beneficial properties has always been relevant. Information on the use of useful species of the family was obtained from literature sources and as a result of long-term ethnobotanical surveys conducted among local communities, and new possibilities of use were identified.

It was found that each of the 15 studied species was of practical importance in one way or another and had a wide range of uses. So, the raw materials of 4 species are mainly used for colds, the fruits of 3 species are used as vitamin plants, raw materials of 5 species are used for anti- inflammatory, and raw materials of 2 species are used for diseases of the gastrointestinal tract. In addition to medicinal value, representatives of the genus have high nutritional value. Most of these species are either added to food in raw form, or various compotes, preserves, jams and syrups are prepared from them.

Most of the representatives of the genus are decorative plants, they are widely used in the greening of cities and towns, and in the construction of living fences. In particular, the studied species of the genus *Crataegus* are noteworthy in this regard.

Some species (*Geum urbanum, Geum rivale and Potentilla anserina*) are used for technical purposes in tanning, and the raw materials of 3 species (*Geum urbanum, Geum rivale* and *Potentillaanserina*) are used for fabric dyeing.

As fodder, the leaves of *Fragaria vesca* and *Rubus saxatilis* are a favorite food of cattle, sheep and pigs, and the berries of *Fragaria viridis* are a favorite food of deer. From all this, it can be concluded that the same species can be effective in the treatment of various diseases and have wide practical importance in a number of fields. According to Use Value (UVi), it was found that *Crataegus monogyna, Crataegus saguinea, Rosa canina, Rubus caesius, Rubus saxatilis, Prunus spinosa* and *Cydonia oblonga* species are more important and widely used species

ETHNOBOTANICAL STUDIES IN THE LOWLANDS OF KARABAKH (TARTAR REGION)

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Damage to both infrastructure and biodiversity in the botanical-geographic regions, which includes the Karabakh territory, continued during the nearly 30-year occupation. Such anthropogenic effects have led to the reduction or complete destruction of a number of plant individuals with valuable prospects for use, and even some ethnic methods of their use have been forgotten among the population. Ethnobotanical studies are of great importance in collecting and documenting the ethnic knowledge of our people. In order to collect ethnobotanical information and conduct floristic research of vegetation in the lowland Karabakh region, monitorings were organized in the territory of Tartar region in the study period in 2023. Tartar region is located in the northeastern foothills of the Lesser Caucasus, in the western part of the Kura-Araz plain, in the Karabakh plain.

The region consists of plains and mountainous areas. Jurassic-Cretaceous sediments are common in the highlands, and anthropogenic sediments in the plains. The climate is semi-desert and dry-desert type with dry summers and mildly cold winters. The amount of annual precipitation is 300-500 mm. Tartar and Injachay flow through the region, and Khachin River flows through the southern border. The area consists of chestnut, gray and meadow-gray soils. The main occupation of the population in the region is cattle breeding, agriculture, cotton growing, viticulture, horticulture.

Lowland vegetation of the region is characterized by wormwood-saltwort sub-deserts, sparsebushy meadows, sparse forests.

The ethnic diversity of the region is an indication of its rich knowledge in the use of useful plants. As a result of the ethnobotanical surveys conducted among 42 local people of different ages and nationalities, it was shown that the middle and old generation are more knowledgeable about the ethnobotanical properties of plants. As a result of the research, the properties and method of use of about 24 plants belonging to 18 families have been discovered, their used parts have been revealed. In general, information was collected on the ethnobotanical use of species such as milfoil, pepper mint, mare's-tail, juniper seeds, wormwood, ulduzca (local name), germander flowers, cephalaria, hollyhock, thyme etc. in a dried form in the flora of the studied region. It became clear that asparagus, hollyhock, jointweed, sunduruk (local name) are used in the

preparation of food while fresh.

It has even been known that some species are used in beekeeping for diseases in bees. The evaluation of the consensus factor of data on different categories of diseases showed that among thepopulation treatment with plants is more effective in gastrointestinal, cardiovascular and nervous diseases (ICF= 0.76-0.89), and in animal husbandry in worm and skin diseases (ICF= 0.56-0.64).

USE OF *ARTEMISIA ABSINTHIUM* L. IN OINTMENT AND SOLUTION FORM IN FOLK MEDICINE

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Plants enrich atmospheric air with oxygen, and are the main and inexhaustible source of a number of therapeutically important substances, including effective medicinal preparations. In this sense, the flora of Azerbaijan can be considered as a source of plants rich in biologically active substances. In one of the ancient legends, it is said: that country is rich and its people are happy,that there is a field of *Artemisia* L. deeply rooted on the chest of its land. The area is reminiscent of a quiet fall aspen forest, a swirl of bluish smoke, and a melancholy humming watermill.

Asteraceae Dumort is one of the main representatives of wild useful, aromatic and aromatic-spicy plants in the flora of Azerbaijan: *Artemisia* L. is a genus belonging to the *Asteraceae* family. Polymorph *Artemisia* L. is taken from the Greek word "artemisia" and means "healthy", "strong". It is an annual, biennial, perennial semi-shrub and herb.

Tu Yu, a Chinese pharmacologist who believes in ancient medicine, discovered artemisinin, a sesquiterpene lactone, in 1972 by studying *Artemisia* L. In 2015, it achieved high efficiency by including artemisinin as the main component of medicines used in the treatment of malaria, which seriously damages people's health. Because of this, he was awarded the Nobel Prize in medicine. The composition of *Artemisia* L. species is rich in minerals: vitamins C, PP, B6, B1, B2, A.

Artemisia absinthium L. and substances obtained from it are used in different ways in local and foreign folk medicine. The bitter substances in its composition stimulate the function of the gastrointestinal and sub-gastric glands, increase the activity of the central nervous system and the circulatory system, antipyretic and antitussive substances are used in the prevention and treatment of malaria, flu and acute respiratory infections accompanied by temperature. Due to its appetizing and astringent properties, it can be used for gastritis, stomach ulcer, dysentery, rheumatism, anemia, jaundice, migraine, hypertension, pulmonary tuberculosis, edema, rheumatism, etc. *A. absinthium* L. is considered the most effective means of fighting cancer. In folk medicine, *Artemisia* L. is applied externally (on the skin) in the form of ointments and solutions to treat various diseases. Sometimes the question arises, if the ointment

is applied to the skin, what benefits the internal organs see. Of course, when placed on the skin, it is absorbed through the skin and has a general effect on the body. Since it contains all minerals and active compounds, the movement function of the liver, the amount of incoming blood, oxygen, and nutritious minerals increase. It is known that there is no greenery in autumn and winter, the plant dries up, and the above-ground parts remain on the stem. In this case, ordinary dry *A. absinthium* is collected, kept in water for 1-2 hours, then wrapped in polyethylene, softened after a day and passed through a meat grinder, used abroad as a medicine. In folk medicine, ointment made from leaves, flowers and roots of *Artemisia* L. is used to heal boils and treat various wounds.

A. absinthium L., which has unique properties, is a useful medicine and an important plant for livestock feed. Considering that polymorph *Artemisia* L. species are irreplaceable in the fight against many diseases due to the wide spectrum of therapeutic use. Therefore, it is recommended to use this rich natural resource effectively and preserve it for future generations.

BIOECOLOGICAL CHARACTERISTICS AND DIRECTIONS OF USE OF *PORTULACA OLERACEA* L. (*GARDEN PURSLANE*)

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Common purslane - *Portulaca oleracea* L. - in many regions of our republic, it is also called portulaca. It is an annual herb. The stem is a plant that spreads over the ground, and its length reaches up to 20-40 cm. The leaves are spherical, dark green in color, the leaves located in the lower part of the stem are alternate, and the upper ones are arranged opposite to each other and dark brown at the bottom. The flowers are yellow. Seed cases are egg-shaped, 4-10 mm long. Flowering and fruiting occur in V-IX months. It is distributed in plain and foothill zones. As a weed plant, it grows more in all districts of the Autonomous Republic in agricultural fields, orchards, and gardens. *Chemical composition.* It contains lutein, β-carotene from carotenoids, and α-linolenic from higher fatty acids. The stem is rich in organic acids such as oxalic acid and lipids. The leaves contain oxalic acid, β-carotene from carotenoids, sitosterol, campesterol, stigmasterol from steroids, glutathione, β-amyrin, butyrospermol, parkeol, cycloartenol from terpenoids, C and α-tocopherol from vitamins, α-linolenic and 3.5% lipid from higher fatty acids. The plant contains minerals such as zinc, copper, nickel, iron, calcium, sodium, magnesium and almost all vitamins, especially vitamin C and A.

Usage. It was first used as a vegetable in Egypt. In the Middle Ages, the Arabs called the purslane "the vegetable of God". It contains little cellulose, and the protein is in digestible form. In most regions of our republic, the young branches of this plant are collected before flowering, and dovga, soup and kutab are cooked. Preserves, juices, soups, etc. are prepared from purslane. Young branches of the plant are boiled in hot water and eaten with garlic and yogurt. Chigirtma and kuku are also cooked from it. Marinading the purslane with garlic and pepper is appetizing. The preparation procedure is as follows: Pepper and garlic are chopped into small pieces according to taste. After boiling in hot water, the freshly harvested purslane is kept in salt water for two days and then chopped. Chopped purslane, garlic and pepper are collected in equal amounts in jars. A few bay leaves and grape vinegar are added to it and closed with a lid. After 2-3 days, vinegar is added if it has decreased significantly. Marinades prepared according to this rule keep their quality for 1-1.5 years. Purslane is also used raw in salads. Harvest period for use is VI-VII months. When the young shoots of the plant are removed, new stems form again from the root collar. It is less demanding on soil. Currently, it is widely cultivated in France,

England, Denmark and Brazil as a vegetable, spice and medicinal plant.

Medical importance. This is a very useful plant, useful for almost everyone, from children to old people. This plant can be regularly used to give skin brightness, vitality, normal functioning of the stomach and intestines, and to eliminate nervous tension and weakness. Aqueous infusion of the plant and its liquid extract increase blood pressure, the infusion of the dried herb relieves inflammation in gastrointestinal diseases, and is used in inflammation of the kidneys and urinary bladder.

Fresh portulaca juice is drunk in diabetes. This plant has been used in folk medicine since ancient times. In China and Egypt BC, they used it in the treatment of infectious diseases, especially dysentery. The great physician Ibn Sina, the ancient Greek physician Hippocrates and the famous botanist Theophrastus gave valuable opinions about the healing properties of the portulaca. Its seeds have a positive effect on heart palpitations and colds. Decoctions made from young plants are used for stomach and liver inflammation, kidney and urinary bladder diseases. It prevents acute and chronic bleeding, the mixture with wine removes warts and papula on the head, soothes headaches. As it contains mucilaginous substances, it helps to soften the stomach and intestines and is easy to digest. It is used as an antiparasitic agent in many countries.

CHARACTERISTIC FEATURES OF *PRANGOS ACAULIS*, SPECIFIC FOR THE FLORA AND CULINARY OF THE NAKHCHIVAN AUTONOMOUS REPUBLIC

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Prangos acaulis is a perennial herbaceous plant with a conical, elongated, woody root. It grows up to 40 cm tall and has an erect, branchy stem. The leaves are pointed, pinnate, and linear, with the apical leaves being smaller. The petals are bearded on the outside. The leaf blades around the root are wide-triangular, with three or four lobes, while the last leaves are obtuse, oblong-linear, and 2-3 mm wide. The leaves of the stem are small and have slightly divided, elongated leaves. The inflorescence is an umbrella with flowers that have bent petals of white or yellow color. The petals are elliptical or ovoid in shape. The umbrellas have 5(4)-6 arms. The fruits are elongated (12-13 mm long) and have wide wavy-curved wings. Flowering occurs in April-May, and fruiting occurs in May-June. The fruits are oblong to ellipsoid in shape with wing-like appendages. The seeds are bent. *P. acaulis* is a xerophyte plant that grows on the plains and in the lower mountain belts, in gypsum, clayey places, and dry valleys. Young plants contain about 2% essential oils. The roots of the plant contain prangenin, imperatorin, oxypeucedanin, osthol, alloimperatorin, xanthotoxin, oxypeucedanin hydrate, and other unidentified coumarins. *P. acaulis* is endangered, so its protection is important. Natural populations must be protected in the Zangezur National Park and the Arpachay State Nature Reserve named after Academician G. Aliyev. *P. acaulis* is widespread in Azerbaijan, mainly in Nakhchivan, Guba, and Gusar. It is very famous in Nakhchivan. The rootsare used for treatment many deseases. A decoction of the roots in water is a good anthelmintic agent, appetizing, strengthens the immune system, useful for prolonged coughs, and useful in the treatment and prevention of cancer due to the rich content of antioxidants.

P. acaulis has many benefits. For example, it speeds up the metabolism and speeds up the work of the intestines. It also plays an important role in the metabolism of sugar in the body and supports the balance of sugar levels. It is used instead of cumin fruit due to its anti-inflammatory and anti-gas effect. The gum resin in the chemical structure of the root has been found to have anthelmintic effects in the intestines. It has also been found to strengthen the heart muscles and prevent narrowing or weakening of the blood vessels around the heart. Anti-cancer and anti-tumor, anti-bacterial action has also been

determined. This plant is also used as an aphrodisiac. In the regions of Azerbaijan, 10-20 cm of fresh stems of the plant are used in spring. They are mainly boiled in water, salted, and eaten, or fermented and used in winter. It is also stewed, fried with onions, and beaten with eggs. It is important to note that pregnant and lactating women should not use *P. acaulis*. The leaves should also not be consumed as they contain oxalic acid and can be poisonous. To make a paste that can be used to treat infertility, mix 200 g of dry saffron roots with 1 kg of honey. Use one teaspoon three times a day before meals. This paste can also be used to increase the number of mobile sperm. *P. acaulis* is a valuable plant with many benefits. It is important to use it wisely and to be aware of its potential side effects.

Figure. *Prangos acaulis*

USEFUL PROPERTIES OF *THERMOPSIS LANCEOLATA* R. BR. IN FOLK MEDICINE

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Thermopsis lanceolata R. BR. is included in *Thermopsis* R. Br genus of *Fabaceae* Lindl. family. The areas of natural distribution of the plant are the eastern regions: Asia, North America, Siberia, Himalayas, China and Japan. It is a perennial herb with a creeping root. The leaves are petiolate and consist of long pseudopods. The flowers usually consist of yellow, sometimes purple petals. The number of stamens is 10. This plant contains ganglioblocking substances, which are biologically active substances. According to its botanical characteristics, *Th. lanceolata* R. Br. is a perennial herb. The aerial parts have horizontal and vertical roots, numerous nodes, and can go to a depth of 2 m or more. The height of the trunk is 60 cm, straight, furrowed, the lower parts are slightly woody, hairy and branched. Thermopsis grass, a wild perennial herb, is considered a quality raw material and medicinal plant when flowering begins. Plants and seeds are used as quality medicine. Its seeds contain 2-3% alkaloids and citrizin. According to their phytochemical composition, the leaves of the lanceolate thermopsis plant contain 1-2,5% of the thermopsin alkaloid homothermopsin, methylcytisine, axicarpine, anagirin, thermopsilazine ester, saponins, inoculants, resin, traces of essential oil, ascorbic acid, alkaloids in seeds, mainly cytisine. The stem contains 1-2.5% alkaloids, derivatives of quinolizide. In addition, it contains thermopsin, hemothermopsin, pachycarpin, anagirin, saponins, grafting agents, resin and other substances. This plant is considered a quality raw material and medicine when flowering begins. Plants and seeds areused as medicine. 2-3% alkaloids and chytrizine were found in its seeds. It is an analeptic drug. It reduces the concentration of nicotine in the blood. The powder and ore of this plant is an antitussive. Extracts made from the plant thin out phlegm. In folk and traditional medicine, high- quality anti-cough solutions, extracts and powders are prepared from the herb according to its use and administration. Methylcytisine contained in the plant accelerates respiration. At the same time, its decoction is used against flu, pneumonia, bronchitis and headaches. Extracts and decoctions have anthelmintic properties, and dry powder has insecticidal properties. The drug Citito from cytisine, obtained from its seeds, is a quality medicinal substance that irritates the respiratory center. At the same time, a drug called tabex is being prepared from citizine, which is used to stop smoking. It is a poisonous plant, even cattle do not eat it. If accidentally eaten, it causes severe poisoning with inflammation of the intestines and stomach, muscle paralysis and death.

MODERN DIRECTIONS OF GEOBOTANY

ACTUAL PROBLEMS OF GEOBOTANY IN AZERBAIJAN

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The dynamically developing economy and social orientation of Azerbaijan's state policy in the 21st century have brought to the fore the problem of the rational use of its natural plant resources. These problems and ways to solve them are clearly defined by the "National Strategy and Action Plan for the Conservation and Rational Use of the Biological Diversity of Azerbaijan", approved by the order of the President of the country (2015). The diversity of the physical-geographical and geological conditions of Azerbaijan determined the formation of flora and plant ecosystems unique in its biodiversity on its territory. Since the 20s of the last century up to the present day, serious scientific work has been and is being carried out to study the vegetation cover of the country. However, the Armenian occupation, the laying of millions of mines and the devastation of more than 20% of our lands interrupted scientific work in this territory for almost thirty years. Today, botanists are faced with the task of conducting scientific geobotanical research on these lands and developing practical recommendations for restoring its vegetation cover. Along with this, the issue of conducting geobotanical research at the modern level throughout Azerbaijan is also relevant.

It is necessary to organize this work at a completely new level, with the application of modern information and communication technologies. These technologies are successfully used to collect information on the species composition and structure of plant communities, assess the state of various ecosystems, study their interconnectivity with physical, geographical and climatic conditions, and solve other issues.

In recent years, the Institute of Botany has developed a good practice of creating databases, compiling GIS maps, developing mathematical modeling and using other modern research methods. Within the framework of geobotanical research carried out in recent years, a summary of the flora of forest ecosystems of the Greater Caucasus (within Azerbaijan) was compiled, an assessment of α-, β-diversity was carried out, the main plant communities were identified and their maps-schemes were drawn up. A list of useful (medicinal, food, fodder, melliferous, dyeing, ornamental, etc.) plants was formed.

In addition, coenopopulations of some rare and endangered species have been studied. The habitats of more than 70 such plants have been clarified, and the state of their coenopopulations has been assessed. Based on the materials of the conducted research, an electronic database was created, including 15

parameters and online maps. For the first time in the republic, predictive mathematical computer models have been developed to assess the risks of shrinking habitats and extinction of rare species. Phenological observations were made on rare plants planted on an experimental plot in the Central Botanical Garden.

Using the technical capabilities of the AZERSKY satellite and drones, photographs were taken of the forest and coastal ecosystems of the Guba and Khachmaz districts, with photographs referenced to a specific shooting location in the WGS-84 coordinate system. The primary processing of the obtained images was carried out and GIS maps of the location of the main background formations were compiled. Studies have shown that the dynamic processes currently taking place in the vegetation cover of the coastal strip are due to climate change and the increasing impact of the anthropogenic factor (infrastructure expansion).

DYNAMICS OF THE FLORA OF THE ABSHERON PENINSULA

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The territories where people have settled since ancient times are especially exposed to the intense impact of human activity. Rapid and profound changes in the plant world are taking place here, requiring special study. The Absheron peninsula is located at the junction of the three most changing cities: Baku, Sumgayit, and Khirdalan; therefore, they are especially interesting in floristic terms. But after the 50s. in the 19th century, studies of the flora of this region were fragmentary and unsystematic.

The decrease in numbers occurred because they were previously divided into several smaller species, now they are prefabricated and accepted in a broader sense, for example, chickweed medium (*Stellaria media* (L.) Vill. = *S. pallida* (Dumort.) Piré; *S. neglecta* Weihe.) and vicia satiava (*Vicia sativa* L. = *V. angustifolia* (L.) L.; *V. cordata* Wulfen ex Hoppe 1. s.1). The dynamics of the flora of the Absheron Peninsula have features that are currently characteristic of most native floras. The number of species is somewhat increasing, but this increase is mainly due to wilding from cultivation and adventitious plants. At the same time, some local species that are subject to anthropogenic impact are unfortunately disappearing. The work on the study of the flora of the environs of the peninsula cannot be considered complete, since every year of field research yields new finds.

The last time the inventory of the flora of the peninsula was carried out in 1953, when the peninsula contained 729 species. As a result of botanical monitoring in 2012–2022, a decrease in the number of species was noted for all areas of the peninsula. The floristic diversity of ecosystems has been reduced from 729 to 714 taxa, which belong to 5 divisions.

Thus, 16 new families entered the flora (*Amaryllidaceae, Araceae, Ceratophyllaceae, Oxalidaceae, Phytolaccaceae, Violaceae, Pinaceae, Moraceae, Oleaceae,* etc.), and 8 families in which 4 families (*Liliaceae = Alliaceae, Asparagaceae, Asphodelaceae, Colchicaceae,* etc.) were combined into one family due to changes in the nomenclature (*Juncaginaceae, Hydrocharitaceae, Anacardiaceae, Santalaceae*) were not found in the flora either during expeditions or during inspection of herbarium funds.

There are broader changes in the dynamics of genera. In Karyagin's list, there are 370 genera; in our list, there are 390. 82 of them are not included in our list since 35 genera have been systematically changed and synonymized. 47

genera (*Adiantum, Ammi, Bellevalia, Cephalaria, Fumana, Malabaila, Scabiosa,* etc.) were not noted by us either in herbarium funds or in nature.

However, there are currently 390 named genera. 102 of them are new genera, 35 (as *Parapholis = Lepturus, Thlaeayme = Lygia, Alyssum = Meniocus, Descurainia = Torularia, Anisantha = Zerna,* etc.) of which are synonymized and have changed names. 67 genera (as *Acalypha* L., *Alliaria* Matthioli & Heist. ex Fabr., *Caesalpinia* L., *Ceratophyllum* L., *Glebionis* Cass., *Lemna* L., etc.) are completely new to the flora of the peninsula.

However, in the dynamics of species, we observe a different picture. So, out of 729 species given by I.I. Karyagin, 187 were not found either during the expeditions or when examining herbarium funds. The existence of 237 taxa is confirmed in the herbarium funds, and 77 named species are culturally mentioned by Karyagin, but we did not find them during expeditions on the peninsula of wild flora.

There are 29 species are given for Absheron after the publication of the book by I.I. Karyagin "Flora of Absheron". In the course of field research, we noted 55 species for the first time in the region. And the remaining 389 species completely coincide with the list by I.I. Karyagin.

CURRENT STATE OF FLORA AND VEGETATION OF AGHSU DISTRICT

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The relief of Aghsu region, located in the Shirvan plain and at the foot of the Greater Caucasus, is mountainous in the north and northwest (Niyaldag, Khingar, Langebiz, etc.), and plain in the south (Shirvan plain).

Girdiman, Aghsuchay and their tributaries Agdarchay and Nazirchay pass through the region. The climate is mild hot dry subtropical. The average temperature in January ranges from -4°C to 1.5°C, in July - 15-27°C. The amount of annual precipitation varies between 340-800 mm.

In mountainous and foothill areas, carbonate mountain-forest, mountain gray-brown soils are common, and on the plains - light chestnut, gray and grass-gray soils. The area is represented by semi-desert, dry steppe, shrub and mountain-forest landscapes. Part of the Shahdag National Park falls on the territory of the Aghsu region. Aghsu pass and Dilman waterfall (The village of Dilman is at the foot of the Niyaldag range.) are the most beautiful natural monuments of geological and landscape character. As the altitude increases from the territory of Dilman village, the greenery also increases. During the researches, vegetation analysis and phytocenological evaluation were carried out on the basis of generally accepted geobotanical and phytocenological methods.

When studying the vegetation of meadow, forest-meadow, forest, mountain xerophytic and tugai forests, as well as when examining early spring vegetation, mainly in the mountain villages of Kalva, Khatman, Dilman and Khadzhiman, with a favorable natural and geographical position, mainly - *Carpinus caucasica*, *Fagus orientalis*, *Quercus iberica*, *Quercus macranthera* etc. also, *Fraxinus exselsior*, *Acer campestre*, *Acer platanoides*,*Ulmus carpinilfolia*, *U.minor*, *Taxus baccata*, *Betula* sp.,*Salix* sp., *Malus orientalis*, *Pyrus caucasica*, *Hipophae rhamnoides*, *Mespilus germanica*, *Sorbus* sp., *Roza* sp., *Crataegus* species, *Prunus divaricata*, *Rhus coriaria*, *Cotinus* sp., *Berberis* sp. and so on. tree-shrub spread was observed.

48 herbarium specimens belonging to 11 families of early spring plants were prepared, GPS data of some localities were recorded. From the flowering species of early spring plants collected during the conducted research - - *Polypodium vulgare* L. (*Polypodiaceae* J.Presl & C.Presl), *Asplenium adianthum-nigrum* L. (*Aspleniaceae* Newman), *Lathraea squamaria* L. (*Orobanchaceae* Vent.), *Tussilago farfara* L. (*Asteraceae* Giseke), *Viola*

odorata L. (*Violaceae* Batsch), *Viscum album* L. (*Santalaceae* R.Br.), *Ficaria calthifolia* Rchb.- (*Ranunculaceae* Juss.), *Corydalis caucasica* DC. (*Papaveraceae* Juss.), *Corydalis sp., Scilla sp., Primula vulgaris* (*Primulaceae* Batsch ex Borkh.), *P. woronowii* Losinsk., *Chelidonium majus* L. (*Brassicaceae* Burnett) and so on. can be shown, some of these are rare and new to the local flora. The famous (*Ophrys caucasica* Grossh.), Khari-bulbul flower, which is considered a symbol of Karabakh, mainly distributed in grassy slopes, forest areas and thickets (blooms in April-June) has always been found in the mountainous areas of Aghsu region (especially in the Bico mountains).

There are many useful plants in the area. Viscum album L. - mistletoe covering forests is hardly used. Young shoots or separate leaves of white mistletoe (lat. Stipites Visci cum foliis) are used in scientific medicine both fresh and dried. So, this plant, which has rich resources, is used both as fodder (mainly for pets in winter) and in scientific medicine for epilepsy, hysteria, dizziness; liquid extract from soft and young branch in pulmonary and nosebleeds; Akofit, obtained from the infusion of its leaves, is used in the treatment of rare types of neurological diseases etc.

VITALITY INDICATORS IN LOCAL POPULATIONS OF *AEGILOPS TRIUNCALIS* L. (UZBEKISTAN)

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The genus *Aegilops* L. consists of ca. 25 species in the world. It constitutes the primary and secondary gene pool for cultivated wheats. Species in the genus are distributed in Southwest and Central Asia and throughout the Mediterranean Basin. Four species of the genus are distributed in the flora of Uzbekistan. Conservation of biodiversity of the wild relatives of wheat is an extremely important issue for improving agricultural production and increasing food security. They are also essential components of natural steppe ecosystems as well as agricultural systems, and are, therefore, vital in maintaining ecosystem sustainability.

The vitality structure of plants is considered one of the important signs indicating that the plant is growing and developing under the influence of external environmental factors. In the course of our research, we studied the vitality structure of *Aegilops triuncalis* L. in nine coenopopulations distributed in the southern regions of Uzbekistan. To determine the vitality structure of the species, the average value of the biometric characteristics of 10 plants from each coenopopulation was taken. The total height, total biomass, spike length, leaf length, and width of the plant were measured. Based on the morphological and biometric indicators of plants, the structure of vitality was evaluated on the basis of 3 criteria: coenopopulations with high vitality (a), medium vitality (b), and low vitality (c).

Signs	CP-1	CP -2	CP -3	CP-4	CP-5	CP-6	CP-7	CP-8	CP-9
Total height (cm)	43,1	38,12	34,1	92,1	85,5	59,4	50,2	66,5	70,4
Biomass (grams)	5,2	4,3	3,6	10,4	8,9	6,2	5,5	6,9	7,6
Spike length (cm)	10,8	8,8	7,2	15,3	12,4	11,3	11	11,7	12
Leaf length (cm)	12,8	10,2	7,8	19,2	15,3	13,4	12,9	14,3	14,7
Leaf width (cm)	0,3	0,1	0,1	0,7	0,5	0,4	0,4	0,5	0,3
IVC	0,50	0,42	0,35	1,50	1,14	0,89	0,78	0,99	1,07
Ecocline	4-5-9-8-6-7-1-2-3								
ISP	1.50/0.35=4.28								
A state of vitality	c	c	c	a	a	b	b	b	b

According to IVC indicators, coenopopulations were evaluated in the scoring system, according to which coenopopulations with a score of 0.35-0.73 are depressed, i.e., low vitality (c), coenopopulations with a score of 0.74-1.12 are balanced (medium vitality) (b), and coenopopulations with a score of 1.13-1.50 are considered high vitality (a). According to the research results, it was found that coenopopulations 1, 2, and 3 are depressed, coenopopulations 4, 5 are good, and coenopopulations 6, 7, 8, and 9 are balanced.

In the course of research, the ecological-phytocenotic description of the studied coenopopulations, the species composition of the plant communities, the dominant species in the community, and the soil description of the studied areas were studied. Based on geographical coordinates, the research area was described.

ECO-GEOBOTANICAL ASSESSMENT AS MODERN GEOBOTANY DIRECTIONS

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The Shirvan region is also subject to the degradation of landscapes and a tendency to desertification, and in this research paper, these processes are the most highlighted ones. According to real biocenoses, a part of the territory of Shirvan, in terms of aridity and climatic indicators, as well as xerophilic and salt vegetation, belongs to desert and semi-desert. The indicators of these ecosystems are xerophytes and halophytes. The irrational use of winter pastures and the failure to take measures to improve their condition resulted in decreased productivity and a deterioration in the quality of forage. The surface coverage of such arid territories is characterized as highly underdeveloped (10-15%).

Objects of research were soil and vegetation of Shirvan zone of Azerbaijan. Bioecological and geobotanical methods; methods for studying vegetation resources and their productivity; ecological methods; soil research methods and pasture assessment methods; bonitation methods have been used.

Both soil and vegetation in Shirvan have independent spatial dynamics to some extent have shown observations. Thus, there may not be an overlay of plant formations on soil contours: several plant formations can be distributed along one soil contour or, conversely, several soil contours can be distributed within one plant formation, which was taken into account when conducting an eco-geobotanical assessment of soil-vegetation cover of Shirvan.

The choice of evaluation criteria and the establishment of an eco-geobotanical assessment scale is one of the most important issues in the eco-geobotanical assessment of soil and vegetation. As with all forms of assessment, the choice of assessment criteria for EGA is associated with certain difficulties. The following formula has been used to determine the eco-geobotanical ball of soil-vegetation cover:

$$E_{gb}= [(B_t + B_p + B_o) + B_e]:n$$

Here, E_{gb} is the eco-geobotanical assessment of soil-vegetation cover; B_t is the yield of grain crops, expressed in ball; B_p is the yield of legumes, expressed in ball; B_o - productivity of motley grass, expressed in ball; B_e- ecological assessment of soils; n is the number of units (ball) participating in the assessment.

For the first time a new methodology for eco-geobotanical assessment of the soil and vegetation cover of the territory of Shirvan was developed based on the data on bonitation and ecological assessment of soils, as well as data on the

assessment of natural plant communities. The eco-geobotanical assessment of the soil-vegetation cover of Shirvan, expressed in balls, made it possible to identify at the first time eco-geobotanical groups on the territory: high productivity (100-81 balls), average productivity (80-61 balls), low productivity (60-41 balls), very low yield (40-20 balls) in the course of our research.

THE MODERN CONDITION OF THE VEGETATION OF THE AREA ALONG THE KURA OF MINGACHEVIR

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The vegetation of the area along the Kura of Mingachevir, which has a rich flora, was formed under the influence of ancient floristic provinces. Mingachevir is located on the shores of the Kura river, bordered by Yevlakh district from the east, south and west, and Mingachevir water reservoir from the north. The purpose of the research was to study the current state of plant cover in the Kura area in Mingachevir.

During the research, while studying the modern condition of the plants found in the wild flora of the Kura area of Mingachevir, their vital forms, geographic and areal types, ecological groups, endemism, and the representatives listed in the "Red Book" were identified using various literary materials: "Geobotany", etc. other geobotanical methods were referred to during desert research. While determining the species composition of the formations found in the research area, the main forage plants were also identified and some of their bioecological characteristics were studied.

While studying the modern condition of the plants found in the wild flora of the Kura region of Mingachevir, a flora conspectus of the species found was prepared and the distribution of 158 species of plants belonging to 30 families and 78 genera in the local flora was determined. In addition, during the research, the types of vegetation found in the Kura area of Mingachevir, and the economically important species spread there were also studied. Thus, 6 vegetation types, 8 formation classes, 9 formation groups, 10 associations were discovered in the territory of Mingachevir, and schemes for the classification of vegetation types were developed.

Based on the relevant taxa, it has been determined that the area is characterized by steppe (dry steppe), semi-desert, saline (halophyte) desert, thicket, water-swamp and forest plant types according to phytocenoses or vegetation classification schemes. Most of the species found in these types of vegetation are valuable fodder plants and are important in the development of livestock in agriculture. Therefore, preservation and conservation of important plant species, the expansion of cultivated areas, and the increase of winter forage reserves in the Kura River area of Mingachevir are of great importance.

Based on the research, it should be noted that the study of the modern condition of the plants found in the wild flora of the Kura region of Mingachevir, the types of vegetation found in the area, the economically important species spread there, including the representatives whose name is included in the "Red Book", is relevant.

THE CLASSIFICATION OF VEGETATION OF THE NAKHCHIVAN AUTONOMOUS REPUBLIC

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The Nakhchivan Autonomous Republic is a mountainous country. The area of the republic is 536.3 thousand hectares. Of these, the mountainous part accounts for 416.3 thousand hectares. The flora and vegetation are rich and unique. At present, in the territory of Nakhchivan

The flora of Autonomous Republic (Nakh.AR) has over 321 plant species belonging to 910 genera and 160 families. Therefore, the study of the vegetation of the region becomes one of the important issues. Information about the classification of individual

Types of vegetation on the territory of the region are available in the works of R.M. Nurieva, A.Sh. Ibragimov, T.G. Talybov, E.M. Kurbanov, V.D. Gadzhiev, S.J. Abdullaeva, N.K. Abbasov and others.

When classifying the vegetation of the region as a whole, 16 subtypes, 21 classes of formations, 310 groups of formations, 13 subgroups of formations, 310 formations, 1700 associations were established.

There are 17 types of vegetation on the territory of the republic:

1. Type of vegetation - Forests
2. Type of vegetation - Shrubs
3. Type of vegetation - Meadows and meadow-steppes
4. Type of vegetation - Wetland
5. Type of vegetation - Oasis
6. Type of vegetation - Arid forests and light forests
7. Type of vegetation - Upland xerophytes
8. Type of vegetation - Steppes
9. Type of vegetation - Semi-deserts
10. Type of vegetation - Deserts
11. Type of vegetation - Petrophytic
12. Type of vegetation - Psammophyte
13. Vegetation type - Ephemero-halyanthium
14. Type of vegetation - Gammada
15. Type of vegetation - Pseudomakki
16. Type of vegetation - synanthropic
17. Type of vegetation - Weed

THE PRINCIPLES OF BEST MANAGEMENT OF AZERBAIJAN FORESTS

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The Azerbaijan forests during many decades administrated without management efficiency, as a result such forest mensuration parameters as mean height, density of trees, bonitet and productivity were decreased.

Our research studies were conducted on the territory 20 block of Amirvar forest district of Shamkir Regional Forest center during summer and autumn seasion of 2022 year. On the territory of different samplings we first studied different questions concerning to composition of tree stand, mean diameters, mean height of the main forest - forming species, such as oriental beech, oriental oak and hornbeam, mean age, bonitet, completeness and producivity of the tree stand. Our studies showed that at block 20 was 15 allotments, most of them covered by forests, but some are light forests and some are uncovered by forest areas. The results of our monitoring which were held during 2022 years in the territory block 20 of Amirvar forest district of Shamkir Forest Regional Center shoved that mean height of trees stand is equal to 22.4m,In the forest covered area age structure consist of from forests with age 90-140 years and teenage tree and shrub species with age 15-20 year. In all allotments forests with intermediate age structure are absent. Teenage species composition includes such species as beech, hornbeam, medlar, hawthorn and hazelnuts. All forests characterized with low level completeness and density. In some places forests are light forests.The wood productivity of forests characterized with low values and varied from 10 to 20 m^3/ha.

Low level mensuration values of forests are required good management strategies which is consist of following steps:

1. All the forests in block 20 should be gradually cutted during 40-60 years and in parallel planted by forest seedlings and seeds of high selection values of forest forming species, such as, oak, beech, hornbeam and other species. As a cutting method gradual and selective tree felling should be used. Since the area of the quarter is approximately 175 hectares, the annual size of tree cutting area will be approximately 3.5 hectares per year.

2. Since the forests of Block 20 are located in the lower mountain belt of the Lesser Caucasus, the felling of trees should be carried out across the mountain slopes.

3.Sowingseeds and planting seedlings should be done by using drones.

4. Taking into account the danger of erosion processes due to tree felling, the area of felling should be fenced off from grazing

5.The forests of Azerbaijan are distinguished by great biodiversity, therefore, before proceeding with the renewal of the forests of Azerbaijan, it is necessary to assess the species composition, abundance, degree of distribution and size of plants growing in the places of future tree cutting area.

6. To assess the biodiversity in the cutting area should be carried out through the use of GIS technologies

7.Felling of trees should not cause damage to biodiversity and after the completion of the felling process, restore of biodiversity should be carried out.

Summary. The best management of Azerbaijan forests consist of gradual cutting of old age trees, and simultaneous planting of saplings by using drons. Also necessary monitoring of biodiversity in cutting area and carrying out works to preserve them.

MYCOLOGY AND MICROBIOLOGY

MICROBIOLOGICAL AND IMMUNOLOGICAL ASPECTS OF ORAL CANDIDIASIS

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In the microflora of the oral cavity, staphylococci, streptococci, lactobacilli, fungi of the genus Candida, etc. are most often found. These pathogens cause various pathologies of the oral cavity. Oral candidiasis is one of the most common among these pathologies. The most common causes of oral candidiasis are local microflora, various manipulations, nutrition, decreased secretion of saliva, changes in its composition, weakening of local immunity, and especially a decrease in the concentration of secretory IgA. For this reason, the aim of our work was to identify oral candidiasis in patients and to study the role of local immune factors in this pathology, in particular, to study the quantitative variability of secretory IgA in saliva. The objects of the study were persons with pathology of the oral cavity. Materials for the examination were taken from 20 people (60% women, 40% men) at the Dental Polyclinic No. 4 of the Azerbaijan Medical University. Pathological material (pus, scrapings) and saliva were taken to detect oral candidiasis in patients, to determine the dynamics of the number of microorganisms in these pathologies, to study the role of local immune factors, in particular, to study the quantitative variability of secretory IgA in the oral fluid. The obtained samples were subjected to microbiological analysis in the laboratory of the Department of Medical Microbiology and Immunology of the Azerbaijan Medical University according to generally accepted methods. To determine secretory IgA in saliva, the method of enzyme-linked immunosorbent assay (ELISA) was used. This method was carried out using a Stat Fax-303 Plus semi-automatic analyzer. The population dynamics and species composition of bacteria and fungi isolated from the studied materials were studied. Candidiasis was diagnosed in 14 patients, stomatitis in 2 and caries in 4. The most frequently detected microorganisms in pathological materials obtained from patients with oral candidiasis are *Candida albicans* (19%), *Streptococcus* spp. (17.9%), *Lactobacillus* spp. (17.8%), *Staphylococcus aureus* (14.8%). Quantitative determination of secretory IgA in the oral fluid of the examined students was carried out by enzyme-linked immunosorbent assay. In patients diagnosed with oral candidiasis, the concentration of secretory immunoglobulin in saliva was below normal (38.0 mg/ml) (180 mg/ml). Taking into account the above, we conclude that the imbalance between local immune factors and microflora creates a direct basis for oral candidiasis.

GROWTH OF *XYLARIA POLYMORPHA* IN SUBMERGED CULTURE

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Submerged cultivation of filamentous fungi has received much attention as a promising approach for the efficient production of their biomass and valuable metabolites. The effects of culture conditions, such as inoculum preparation, composition and volume of the nutrient medium, pH, temperature, etc. on biomass and metabolites production are of particular interest.

A comparative study of the growth dynamics of *X. polymorpha* strain IBK 2736 under submerged cultivation using different volumes of the nutrient medium was conducted. The fungal strain was obtained from the *IBK* Culture Collection (M.G. Kholodny Institute of Botany, NASU) and cultivated on the glucose-yeast-peptone medium (g/L: glucose – 25, yeast extract – 3, peptone – 3, $MgSO_4$ – 0,25; KH_2PO_4 – 1; K_2HPO_4) on a laboratory shaker (agitation speed 120 rpm) at 25 ± 1 °C. Cultivation was performed in a 250-mL (50 and 100 mL of working medium) Erlenmeyer flasks inoculated with 10% (v/v) mycelium, initially grown for 7 days at 25 ± 1 °C on a glucose-yeast-peptone agar medium, in 6 replicants. To analyse the dynamics of biomass accumulation the amount of mycelial biomass was measured every 24 hours (up to 10 days). To determine the biomass concentration, mycelium was separated from the culture liquid and dried at 60 °C to a constant weight. The biomass concentration was calculated in grams of dry matter per 1 liter of the medium.

It was found that the lag phase lasted up to 2 days, after which the rate of accumulation of mycelial biomass increased significantly, which is typical for the exponential phase of growth. Growing in 50 ml of nutrient medium, the maximum biomass yield was observed on the 8^{th} day of cultivation and amounted to 19,6 g/l. After that, active growth ceased and the amount of biomass gradually decreased as a result of autolysis to 15,7 g/l on the 9^{th} and 14,8 g/l on the 10^{th} (last) day of cultivation.

At the same time, growing in 100 ml of medium, an increase in mycelial biomass was observed by the 10th day of cultivation, indicating an active phase of growth. We have noted 8,69 g/l on the 7^{th} and 11,96 g/l on the 10^{th} day of cultivation. In both cases, the pH of the culture liquid dropped insignificantly – by 0,5 of an initial value, which can be explained by the high buffering capacity of the selected nutrient medium. The mycelium grew in the form of pellets in submerged cultivation using both media volumes. However, mycelium cultivated per 100 ml of medium, formed larger pellets with short hairy

filaments on the pellet surface. In contrast to cultivation on agar medium and in surface liquid culture, the mycelium did not acquire a dark coloration. However, it is suggested that the duration of cultivation can be prolonged to observe the appearance of dark coloration with an increase in the amount of culture medium.

Thus, the glucose-yeast-peptone complex nutrient medium proved to be favorable for the growth of *X. polymorpha* strain IBK 2736 and provided a high yield of mycelium mass. The duration of the active phase of mycelial growth increased with the volume of the medium. The highest yield was obtained on the 8^{th} day of cultivation in 50 ml of medium, and it amounted to 19,6 g/l, which is relatively significant. At the same time, the strain possessed characteristic morphological features that allow for controlling the purity of culture. During the growth period, the pH varied within insignificant limits.

POLYMORPHISM AND BIOLOGICAL ACTIVITY IN FUNGI

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The purpose of the presented work is to clarify how its physiological-biochemical properties affect the intraspecific polymorphism of Ganoderma lucidum mushroom. The reason for setting such a goal is that the selection of the producer of metabolites with biological, including pharmacological activity, is carried out through complex and multi-stage processes. This, in turn, leads to the consumption of a lot of time, energy and materials. On the other hand, fungi belonging to the same species differ significantly from each other according to their morphological appearance, and they can be characterized as separate species.. Clarification of this issue will allow obtaining information that facilitates the selection process during the initial evaluation of fungal strains belonging to the same species in the future.

Many species of fungus belonging to the genus *Ganoderma* P. Karst have important medicinal value. The fungi *Ganoderma lucidum* stands out among the species distributed in Azerbaijan due to the diversity of the research area in the world, as well as the wide range of metabolites with biological, including pharmacological activity that they synthesize, as well as the high growth rate of *Ganoderma lucidum*, bred in pure culture, fruiting body (FB), formed in natural conditions) due to the fact that it visually differs more in forms, and that it synthesizes metabolites with different functional activity, at least quantitatively differs at the strain level , a wider study of this species in the conditions of Azerbaijan is considered necessary.

As a result of the research conducted in this direction, it became clear that the G. lucidum fungi is unevenly distributed in ecologically different areas of Azerbaijan, and the natural climate and flora of the Greater Caucasus, primarily the Guba-Khachmaz economic district, are more favorable for its distribution. Thus, 57.1% of the fungi fruit bodies recorded in the studies fall on the share of the forests located in the mentioned area.

Fruiting bodies of the fungus *G.lucidum* can be visually differentiated in nature according to the characteristic features of morphological differences, their fruiting bodies are similar to polypors- and cap fungi and can be characterized as a separate polymorphic group.

During the comparative study of pure cultured strains belonging to each group, the first clear issue is that polymorphism manifests itself to one degree or another at the level of cultural-morphological traits, biomass yield, antibiotic activity and other characteristics.

These facts will be useful in the selection of active cultures (based on biomass yield, antibiotic activity, etc.) belonging to fungal as a first-mentioned indicator and will greatly facilitate the screening process.

FUNGI (*ASCOMYCOTA*) OF GOYGOL NATIONAL PARK AND SURROUNDING AREAS

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Fungi are one of the largest eukaryotic kingdoms, numbering approximately 1.5–12 million species. Ascomycota was considered the largest subdivision of the fungal world, assumed to evolve 650–550 million years ago, and there are currently about 92,700 described species. Many are microscopic fungi associated with plants, but there are also fungi that form visible fruiting bodies from the Morchellaceae, Tuberaceae, and Pezizaceae families. The classification of these fungi has been repeatedly updated, and according to the modern classification, three subphylums are distinguished within the phylum: Pezizomycotina, Saccharomycotina, and Taphrinomycotina. About 1544 genera are listed as Incertae sedis.

Fungal samples were collected from Goygol National Park and adjacent areas, mainly from villages Ashigli, Chaykend, Toganali, Hajikand and Ganja city. Trees occurring in the study area mainly are *Fagus orientalis* Lipsky, *Quercus macranthera* Fisch. & C.A. Mey., *Carpinus betulus* L., *Betula pendula* Roth, *Fraxinus excelsior* L., *Acer holdreichii* subsp. *trautvetteri* (Medw.) AE Murray, *Tilia rubra* subsp. *caucasica* (Rupr.) V. Engel and of the conifers *Pinus hamata* Sosn. *Cornus mas* L. and the most common shrubs are *Berberis vulgaris* L., *Berberis integerrima* Bunge, *Rosa canina* L., *Mespilus germanica* L., and *Punica granatum* L. Specimens stored in the mycological herbarium of the Institute of Botany (BAK) and additionally collected during expeditions in 2021–2022 were analyzed. Different approaches and determinants were used to identify species. In addition to symptomatic characters, important microscopic diagnostic parameters (structure, color, size, and shape) were considered. Specimens were mainly observed with a microscope (Carl Zeiss, Germany), measurements were made at 40x, and the result was calculated as the average of the calculations for each specimen. Species names and taxonomic units were checked against MycoBank and the World Flora Online databases.

Taking into account recent taxonomic and nomenclatural innovations, the taxonomic structure of fungi was determined. The studied species of fungi include 8 classes (including 2 Insertae sedis), 26 orders (3 Insertae sedis), 52 families (4 Insertae sedis), 146 species of 85 genera belonging to the suborder Taphrinomycotina, Pezizomycotina, and one Incertae sedis. Altogether 53 stems

and 80 leafs samples were analyzed and identified; fungi associated with both leaves and stems were examined in 3 samples, and fungi associated with fruits and cones in 5 samples. Among them, the species *Taphrina pruni* (Fuck.) Tul. develops in the stems, fruits, and seeds of *Prunus cerasifera* Ehrh. The fungi *Golovinomyces* cichoracearum (DC.) Heluta and *Podosphaera fusca* (Fr.) U. Braun & Shishkoff were found respectively on leaves, stems and flowers of *Centaurea cheiranthifolia* Willd. and *Cota triumfetti* (All.) J. Gey. The species *Sphaeropsis* quercina (Schwein.) W.A. Archer, is defined in the cones of the multiflower *Quercus petraea* subsp. *polycarpa* (Schur) Raus. A few macromycete species (*Peziza repanda* Wahlenb. ex Fr., *Tarzetta catinus* (Holmsk.) Korf & J.K. Rogers, *Jackrogersella cohaerens* (Pers.) L. Wendt, Kuhnert & M. Stadler, and *Xylaria carpophila* (Pers.) Fr.) were new for the study area.

FUNGAL DIVERSITY OF *FAGUS ORIENTALIS* LIPSKY. IN AZERBAIJAN

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Fungi are among the most important organisms in the world due to their vital roles in ecosystem functions. Less than 10% of the known fungi on forest trees are pathogenic species. These fungi in most cases are evolutionarily linked with their host plants. Ways of distribution of fungi on trees, especially pathogenic ones, are very different. Fungi that spread in a certain geographical area have serious genetic barriers. The role of herbariums in compiling lists of species existing in the country is important. Herbariums are also essential as a place to store specimens and collect biodiversity data.

Fagus L. is one of the forest tree genus belonging to the beech family (*Fagaceae* Dumort.), represented by 11 species in the worldwide. Only one specie of beech – *Fagus orientalis* Lipsky. occurs in Azerbaijan. Beech is one of the main forest-forming trees in the European continent, as well as in Azerbaijan. Beech tree grows in all physical and geographical regions of the country. Beech is widely used in the construction and furniture industry due to its high-quality firewood. Mycobiota of beech in our country has been studied since the middle of the last century and a number of data have been published.

In the present study, we report about 92 fungal specimens occuring on beech tree stored in the mycological herbarium of the Institute of Botany (BAK). Samples were taken in the summer, mainly in June-August. Specimens were analyzed to study the micromycete diversity of beech. Investigated specimens are identified as 83 species belong to 4 classes, 12 orders, 39 families, and 55 genera. In terms of the number of specimens, the families Diatrypaceae Nitsche. (11,) and Phyllostictaceae Fr. (8) predominate. Diatrypaceae is presented with six genera (*Cryptosphaeria* Petr., *Diatrype* (Hoffm.) Fr., *Diatrypella* (Fr.) Nitschke., *Fusicoccum* Corda., *Eutypella* (Pers.) Rappaz., *Quaternaria* Tul.) and 10 species, and Phyllostictaceae with single genus *Phyllosticta* Pers. and 6 species.

When analyzing the occurrence of species by physiogeographic regions, it was revealed that samples of micromycetes were collected mainly from the Greater Caucasus (50) and the area of the Kura valley (23). Most of the specimens registered in the herbarium are from the Gusar district (17) in the region of the Greater Caucasus and from the city of Ganja (16) in the Kura valley region.

STUDY OF THE MYCOBIOTA OF FODDER PLANTS CULTIVATED IN AZERBAIJAN

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Although the Republic of Azerbaijan is characterized as an area with an important role of the agricultural sector, this sector is capable of meeting 50% of the needs of the country's population. This once again proves the importance of increasing the efficiency of production of agricultural products.

It should be noted that the reduction of the yield in the agrarian field may be caused either by changes in political and economic relations, or by the effects of various diseases. For this reason, it is important to always pay attention to the second cause of crop loss. Thus, the fight against diseases carried out only within the borders of one country is not so effective today, that is, the pathologies caused by microorganisms do not know borders.

Fungi, which are found in all places where organic matter is found, including plants with all life forms (trees, shrubs and grasses), have enzyme systems or special infection organs capable of breaking down the plant cell wall, which allows them to infect plants both vegetatively and gives the opportunity to cause various pathologies in the generative organs. As a result, the overall productivity of plants decreases, the quality of the product obtained from it changes negatively, the aesthetic appearance of the plant, as well as the product obtained from it, deteriorates. Therefore, it is important to consider the fact that the fungi that cause various pathologies in plants, including those used for practical purposes, become the subject of separate studies. On the other hand, the mysterious world of fungi and the fact that they have a wide range of biological characteristics have made them the main object of various studies. One of such fields is their phytopathological study. In recent times, the impact of the anthropogenic factor on the environment has increased, and as a result of this process, the ecological situation is changing not only locally or regionally, but also on a global scale, and unfortunately, in most cases, this change is observed in the direction of deterioration.

Against the background of the tasks brought forward by the research conducted in this direction, providing the world's population with agricultural products, including those obtained from animals, is one of the special focus areas.

Most of the fodder of large and small horned cattle raised for food purposes is made up of plants. Plants are one of the food sources not only for

animals, but also for microorganisms, including fungi. As a result of this, various relationships have been formed between plants and fungi, one of which is the pathologies caused by fungi in plants. So, as a result of the diseases caused by fungi, the crop loss observed every year is measured in millions of tons. The damage caused by fungi to plants is not limited to this, and fungi also enrich the plants they inhabit with the metabolites they produce as a result of their life activities, which include those that can cause dangerous consequences for both the animals themselves and the animals that use the animals for food purposes. A clear example of this is mycotoxins, which are compared to weapons of mass destruction and are synthesized by fungi. In order to prevent diseases caused by natural fungi, it is very important to thoroughly study the plants used by animals as fodder and to collect basic data to prepare effective measures against them.

SPECIES OF THE FAMILY *AGARICACEAE* CHEVALL DISTRIBUTED IN THE SHAHBUZ DISTRICT OF THE NAKHCHIVAN AUTONOMOUS REPUBLIC

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The study of mushrooms, carried out in the Shahbuz region, showed that the species composition of the territory is rich. As a result of the research, 93 species of mushrooms were identified belonging to 2 classes, 7 orders, 25 families, and 57 genera, of which 84 species belonging to 16 families and 45 genera were new for the mycobiota of Nakhchivan. Among the detected fungi, five genera – *Mycenastrum* Desv., *Tephrocybe* Donk, *Leucocortinarius* (J.E.Lange) Singer, *Trichaster* Czern., *Montagnea* Fr. and 19 species – *Leucoagaricus nympharum* (Kalchbr.) Bon, *Lycoperdon nigrescens* Pers., *L. spadiceum* Schaeff., *Calvatia gigantea* (Batsch) Lloyd, *Mycenastrum corium* (Guers.) Desv., *Agrocybe arenicola* (Berk.) Singer, *Psilocybe semilanceata* (Fr.) P.Kumm., *Pleurotus eryngii* (DC.) Quel., *Clitocybe candida* Bres., *Tricholoma sejunctum* (Sowerby) Quel, *Leucocortinarius bulbiger* (Alb. & Schwein.) Singer, *Tephrocybe rancida* (Fr.) Donk, *Psathyrella frustulenta* (Fr.) A.H. Smith., *Naucoria cerodes* (Fr.) P. Kumm., *Hygrophorus nitidus* Berk. et M.A.Curtis., *Marasmius collinus* (Scop.) Singer, *Geastrum minimum* Schwein., *Trichaster melanocephales* Czern., *Montagnea arenaria* (DC.) Zeller were reported for the first time for Azerbaijan. Mushrooms belonging to the Agaricaceae family were dominated with 25 species belonging to 12 genera among the collected specimens. Thus, mushrooms belonging to Agaricaceae family distributed in Shahbuz district represented as follows based on genera: *Agaricus* L. (*A. campestris* L., *A. silvaticus* Schaeff., *A. xanthodermus* Genev., *A. abruptibulbus* Peck.), *Battarrea* Pers. (*B. phalloides* (Dicks.) Pers.), *Bovista* Pers. (*B. plumbea* Pers.), *Coprinus* Pers. (*C. comatus* (O.F. Müll.) Pers.), *Calvatia* Fr. (*C. gigantea* (Batsch) Lloyd, *Calvatia utriformis* (Bull.) Jaap.), *Lycoperdon* Pers. (*L. perlatum* Pers., *L. pyriforme* Schaeff., *L. decipiens* Durieu & Mont., *L.nigrescens* Wahlenb., *L. spadiceum* Schaeff.), *Leucoagaricus* Locq. ex Singer (*L. carneifolius* (Gillet) Wasser, *L. leucothites* (Vittad.) Wasser, *L. nympharum* (Kalchbr.) Bon), *Macrolepiota* Singer (*M. procera* (Scop.) Singer, *M. excoriata* (Schaeff.) M.M.Moser, *M.mastoidea* (Fr.) Singer, *M. fuliginosa* (Barla) Bon.), *Montagnea* Fr. (*M. arenaria* (DC.) Zeller), *Mycenastrum* Desv. (*M. corium* (Guers. ex DC.) Desv.), *Tulostoma* Pers. (*T. volvulatum* Kalchbr.), *Vascellum* F. Smarda (*V. pratense* (Pers.) Kreisel). As a result, the current status

of the species belonging to the Agaricaceae family has been clarified, and the reasons for their extinction have been investigated. Among them, the species *Calvatia gigantea (*Batsch) Lloyd, *Battarrea phalloides* (Dicks.) Pers., *Montagnea arenararia* (DC.) Zeller are included in the 3rd edition of the Red Book Azerbaijan as rare and endangered, and methods of protection are indicated. The protection of *Battarrea phalloides* (Dicks.) Pers., *Montagnea arenaria* (DC.) Zeller, *Calvatia gigantea* (Batsch) Lloyd species in their growing places in Zangezur National Park named after academician Hasan Aliyev have gradually narrowing, as a species close to danger, should be strengthened and the limiting effect of anthropogenic factors should be eliminated.

FUNGI OF THE GENUS *ASCOCHYTA* LIB. OCCURING ON HERBS IN AZERBAIJAN

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The genus *Ascochyta* Lib. (Didymellaceae, Pleosporales), described by M.A Libert in 1830. This is the largest genera of pycnidial fungi and includes about 1400 species found worldwide on wild and cultivated plants, which leads to economic losses because of the disease they cause. The spherical or conical pycnidia of *Ascochyta* fungi, which form spots on the aboveground organs of the plant, completely or partially penetrate the plant tissue. The anamorphs of the genus are mainly characterized by pycnidia with ostiole, uniseptate, colorless or pale colored conidia. Conidia are cylindrical, ovoid, ellipsoidal, or spore-shaped, spores are straight or curved in the middle, and may be transparent or slightly colored. Teleomorphs mainly belong to the genus *Didymella* Sacc., and some species belong to *Leptosphaeria* Ces. & De Ne. (Pleosporales) and *Mycosphaerella* Johanson (Capnodiales).

Ascochyta has been investigated by a number of researchers in Azerbaijan. The purpose of this study was to analyze the herbarium materials of *Ascochyta* species recorded in herbaceous plants of Azerbaijan on the basis of newly collected samples, herbarium specimens (BAK) and available literature data. The specimens observed in a light microscope (Nikon Eclipse E100, Japan), and appropriate literature were used for identification.

Calculations for diagnostically significant structures were performed as the average of every 15–20 measurements. The groups of host plants were determined taking into account modern phylogenetic approaches and the status of plant species was clarified based on the World Flora Online database. As a result of the conducted work, 12 species of fungi (*Ascochyta althaeina* Sacc.et Bizz., *A. androsaces* T.M.Achundov, *A. boltshauseri* Sacc., *A. graminicola* Sacc., *A. kleinii* Bubák, *A. lathyri* Trail., *A. pedicularis* (Rostr.) Arx, *A. plantaginicola* Melnik, *A. solanicola* Oudem., *A. stellariae* Fautr., *A. tussilaginis* Oudem., *A. violae* Sacc. & Speg.) were observed on 12 plant species (*Alcea tabrisiana* (Boiss. & Buhse) Iljin, *Androsace maxima* L., *Vicia narbonensis* L., *Polypogon monspeliensis* Desf., *Calystegia sepium* (L.) R.Br., *Lathyrus aphaca*

L., *Pedicularis sibthorpii* Boiss., *Plantago major* L., *Solanum nigrum* L., *Stellaria media* (L.) Cyr., *Tussilago farfara* L., *Viola canina* L.) belonging to 10 families and 12 genera. Three fungal species of the genus (*A. boltshauseri, A. lathyri, A. violae*) were identified on plants belonging to the *Fabaceae* family.

NITRATE REDUCTASE ACTIVITY OF SOYBEAN PLANTS GROWN IN SALINE MEDIUM AND WITH THE PARTICIPATION OF TRICHODERMA

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Observations show that agricultural production is more dependent on environmental factors resulting from the impact of human activities, which significantly change soil characteristics, plant productivity, and product quality. Unfavorable conditions created as a result of anthropogenic effects, including salinity, have a toxic effect on the activity of enzymes that catalyze the implementation of metabolic processes in plants, reducing their productivity. During the cultivation of the soybean plant in our republic, attention is mainly paid to the economically important signs of the plant, but until today, little attention is paid to the biologically active substances and enzymes that play an important role in the adaptation of the plant to unfavorable environmental conditions, including nitrate reductase, one of the enzymes of primary nitrogen metabolism. This enzyme catalyzes the conversion of nitrates in the soil to ammonia, being absorbed by plants. In symbiosis with rhizobium rhizobium bacteria, the soybean plant absorbs atmospheric nitrogen and meets its own nitrogen demand and participates in enriching the soil with compounds of this element. Recently, more biological methods have been used to increase the tolerance of plants to unfavorable environmental conditions. In this sense, the use of micromysts, which live in the rhizosphere of plants and act in symbiosis with them, has become relevant. The biologically active substances they synthesize have a positive effect on the metabolic processes in plants and increase their tolerance to unfavorable conditions. Therefore, the changes in some morphological parameters of soybean plants and the activity of nitrate reductase enzyme were studied in chloride salinity with the presence of *Trichoderma asperellum* fungus.

As a research material, “Bravo” variety of soybean plant was used. First, some of the seeds of the plant were soaked in the culture solution of trichoderma for about 15-16 hours. 5-day-old seedlings were grown in water culture (plants of the experiment at 50mM and 100mM NaCl salinity) in Knop nutrient medium (1n, pH-6) in 1-liter vegetation pots. Nitrate reductase enzyme activity was

determined in a spectrophotometer (Genesys 20, Thermo Scientific, USA) at 648 nm optical density.

Nitrate reductase enzyme activity in 3-week-old soybean plant organs showed that low salinity (50 mM NaCl) had no significant toxic effect on enzyme activity. Thus, the activity of the enzyme in the organs of the plant decreases by 20-22%. Increasing the concentration by 100 mM caused a 4.1-fold decrease in the activity of the enzyme in the leaves, 2.8-fold in the stems, and 3.7-fold in the roots. In the plants treated with the culture solution of Trichoderma, we found that the activity of the enzyme was restored in all organs of the soybean. At 50 mM NaCl salinity, we observed that the activity of the enzyme in leaves, stems and roots of soybean reached approximately the level of nitrate reductase activity of control plants due to the effect of trichoderma. At 100 mM NaCl salinity, we found that trichoderma nitrate reductase activity increased 3.6 times in leaves, 1.8 times in stems, and 3.1 times in roots.

It can be concluded that, depending on its concentration, chloride salinity has a negative effect on the activity of the nitrate reductase enzyme in soybean organs, and *Trichoderma asperellum* micromycete increases the activity of the enzyme both in normal and saline environments due to the biologically active substances it secretes.

ANTIFUNGAL PROPERTY OF SOYBEAN RHIZOBACTERIUM

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Soybean (*Glycine max* (L.) Merr.) is the most common and useful protein-oil crop in world agriculture. Species of *Bradyrhizobium* japonicum (Kirchner 1896) Jordan, 1982 play an important role in obtaining higher yields of soybeans. They enter into a symbiotic relationship with the plant and provide it with biological nitrogen. A symbiotic group of root nodulating bacteria (RNB) of soybeans has the ability to absorb atmospheric nitrogen and enrich the soil with natural nitrogen, thereby stimulating productivity. Increasing agricultural production is essential to ensure global food security and food for a growing population.

Losses of agricultural products due to pathogenic fungi are 70-80%. Pathogenic fungi pose the greatest threat to crop mortality. In our experiments, we studied the antifungal properties of soybean RNB strains. We analyzed strains that suppress the growth of fusarium and cladosporiosis pathogens. Antagonistic experiments were carried out to study the antifungal properties of several strains of soybean rhizobial bacteria against pathogenic fungi. Experiments carried out in the laboratory show that rhizobacteria isolated from soybean roots have antifungal properties against species of *Fusarium* Link, which is common on crops of the most dangerous pathogenic fungus. The obtained results show that among rhizobacteria strains – X12[1], X13[2], П2[2], T1[2], T17[3], O7[2], Ty1[1], M5[1], Б21[3] cessation of growth of pathogenic fungi was observed in *F. culmorum* (Wm.G. Sm.) Sacc., *F. poae* (Peck) Wollenw., *F. verticillioides* (Sacc.) Nirenberg and *F. oxysporum* Schltdl.

This was confirmed by the diameters of the growth inhibition zones of the tested bacteria, which are 17-40 mm or more and correspond to a high and very high level of antagonistic activity of the experimental samples. The growth inhibition zones of pathogenic fungi were different for different strains. Effect of X12[1] strain to the pathogen *F. culmorum* of the diameters of the growth inhibition zones was 12 mm, to the *Cladosporium* sp. – 28 mm, to *F. oxysporum* – 17 mm and to the *P. chrysogenum* Thom – 20 mm.

In *F. verticillioides* colonies similar results were obtained with strains Ty1[1] (32 mm), П2[2] (34 mm), Б21[3] (36 mm), the results with colonies of *P.*

chrysogenum differed in different strains of bacterial strains $X13^2$ (40 mm), $X12^2$ (36 mm), $П2^2$ (32 mm), $Б21^3$ (36 mm). The diameters of growth inhibition zones in the colony of *F. oxysporum* with strain $X12^1$ was 17 mm, and in *F. culmorim* with strain $Ty1^1$ was 34 mm.

Thus, soybean RNB are able to protect agricultural crops from pathogenic fungi, and the introduction of bacteria into the soil and rhizosphere of plants acts as a biofungicide and enriches the soil with molecular nitrogen. Microorganisms in soybean rhizospheres stimulate the growth and development of plants, and also exercise biocontrol against phytopathogens that cause the death of crops. Therefore, on their basis, it is possible to create local highly effective biofungicides and use them in agriculture to achieve environmentally friendly, high productivity. The obtained strains of rhizobacteria can be used for such purposes as biofungicides to protect plants from pathogenic fungi. In addition, rhizobacteria effectively replenish the soil with nitrogen and increase yields.

MOLECULAR ASSESSMENT OF VIRUS ACCUMULATION LEVEL IN TOMATO PLANT TISSUES INFECTED WITH TOMATO BROWN RUGOSE FRUIT VIRUS (TOBRFV)

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Tomato is one of the main agricultural crops cultivated in Uzbekistan. It is annually cultivated on 60,000 hectares with the total yield ca. 1.6 million tons.

Various pests and pathogens throughout its vegetation period may cause considerable decrease in the quality of tomatoes and thus affect the farmers' income. E.g., due to consequences caused by viral diseases, ca. 70% of the crop is lost, quality of tomatoes deteriorates, transportability and other properties decrease.

As a result of infection of tomato plants with complex viruses (tobamoviruses, potexviruses, tospoviruses) the damage may result in 100%, and there are cases of tomato plants drying up on large cultivated areas before the end of the production season. Tomato Brown Rugose Fruit Virus (ToBRFV), a member of the Tobamavirus family, is a serious pest of tomatoes grown in greenhouses. For the first time, ToBRFV was discovered in Israel in 2014, where it widely spread in greenhouses specializing on tomato production. Tomato (*S. lycopersicum*) and pepper (*C. annuum*) are the confirmed economically important natural hosts of the virus.

The aim of the studies was to conduct molecular assessment of the level of infection and density of ToBRFV in plant tissues and to study the dynamics of the latent period of the disease. The areas under tomatoes (Alamino variety) cultivated in the farms of the Zangiota district of the Tashkent region were surveyed and the ways and conditions of transmission of the disease were studied. To isolate total RNA from plants, fruit and leaf tissues were diagonally collected into separate plastic bags from different points of the field.

Since viral diseases may present visual symptoms similar to each other, the use of modern molecular methods is crucial in making an accurate diagnosis of the disease. The PCR method was used to detect ToBRFV in the isolated samples of total RNA. PCR was performed on infected tomato fruit and leaf samples diluted to 10^{-10}; ToBRFV virus was not detected in samples diluted to 10^{-9} and 10^{-10}. PCR analysis revealed that the level of virus accumulation in a number of tomato fruits was higher than in leaf tissue.

As a result of the study, it was established that tomato (*S. lycopersicum*) in Uzbekistan is infected by phytopathogenic viruses belonging to different

families and possessing different physical characteristics. The common indicator plant and immunological methods may be used for determination of the viruses in tomato plants, but the molecular method for detecting viruses is the most sensitive method.

To decrease losses from this disease, it is important to use certified seeds and seedlings, to increase plant immunity, to combat pests-vectors of viruses, and to set up phytosanitary control on farms where the virus is detected.

SEPSIS-CAUSING CONDITIONALLY PATHOGENIC BACTERIA (OPPORTUNISTIC)

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Sepsis is a severe infectious disease caused by various microorganisms (bacteria, viruses, fungi) and their toxins, and is a systemic infectious complication that manifests itself with the same clinical symptoms regardless of hemodynamic changes and the type of causative agent. Sepsis is the growth and reproduction of microorganisms entering the bloodstream. It mainly occurs in organisms with a weakened immune system. Therefore, it is mostly caused by conditionally-pathogenic microorganisms (opportunistic). During this condition, the body's unique response is not only related to the infectious agent and the immune response it causes, but also significant changes such as coagulation, immunosuppression, and organ dysfunction occur. The annual incidence of severe sepsis and septic shock is up to 300 cases per 100,000 in the United States. The fact that sepsis is a serious health problem is proven by the fact that approximately 2.5 million newborns die each year in the world alone. The LPS/LBP/CD14 complex of Gram (-) bacteria induces cytokine secretion from the macrophage membrane. A few minutes later, the synthesis of proinflammatory or anti-inflammatory cytokines (IL-1-2-6-8-15, TNF, etc.) is a systemic Inflammatory Response Syndrom – SIRS or Compensatory anti-inflammatory response syndrome (CARS) occur. The presence of two of the three criteria of the SOFA (Sequential Organ Failure Assessment) scale is sufficient to confirm sepsis. The cause of occurrence can be purulent-inflammatory diseases of the skin (abscess, carbuncle, phlegmon), extensive trauma, burns, infectious and inflammatory diseases of the urinary system (pyelonephritis), severe tonsillitis in the abdomen (peritonitis, pancreatitis), purulent otitis, pneumonia, childbirth or abortion infections etc. The aim of the study was to carry out microbiological diagnosis of conditionally pathogenic bacteria that cause sepsis. Blood taken from 47 suspected sepsis patients treated in the Reanimation and Intensive Care Unit (RICU) was examined by microbiological methods. In order to obtain hemoculture (blood cultivation), 5-10 ml of blood taken from the patient was inoculated in 50-100 ml of liquid nutrient medium and incubated for 1-3 days, sensitivity to antibiotics was identified and treatment was prescribed. It was identified by obtaining hemaculture from Bactec automatic system and using bacteriological method.

Klebsiella spp. was discovered in 12 (26%) patients with respiratory tract infection, *S.aureus* in 10 (21%) people with soft tissue infections (burn, surgery, trauma), *P.aeruginosa* in 9 (19%) patients, *E.coli* in 8 (17%) patients, *S.aureus* in 5 (11%) patients with angiogenic infection and *CoNS* in 3 (6%) patients. Broad-spectrum beta-lactamase - BSBL (+) was determined in 7 (58%) *Klebsiella spp.* strains isolated from blood and showed resistance to β-lactam antibiotics. Methicillin-resistant *S. aureus* (MRSA) strains were detected in 4 (40%) strains of S. aureus. Among the etiological factors of sepsis in the last period some Gram-negative bacteria synthesizing GSBL, carbapenemase, and other enzymes, and MRSA strains play a key role, causing difficulty in treatment. Given this, antibiotics to which these bacteria are resistant should not be used during treatment. In the treatment of infections caused by GSBL-synthesizing bacteria, carbapenems, fosfomicin, nitrofurantoin, and tigecycline, to which they are sensitive, should be used, on the contrary, from antibiotics to which they are resistant, penicillins (especially ampicillin), second- and third-generation cephalosporins, and trimethoprim/sulfamethoxazole are not recommended. Despite advances in medicine, septic shock remains one of the leading causes of death in critically ill patients.

GENETIC TRANSFORMATION OF LOCAL VARIETIES OF WHEAT (*TRITICUM AESTIVUM* L.) BY AN EFFECTIVE *IN PLANTA* METHOD USING *AGROBACTERIUM TUMEFACIENS*

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Wheat is an important crop in Uzbekistan, which is cultivated in the large territories of the republic. However, there are problems in production and marketing of wheat. First of all, this is due to the low quality of local wheat flour. Thus, there is a need for genetic improvement of wheat, aimed at improving the quality of flour. In this regard, we used *RNAi* technology.

Our goal was to obtain new biotechnological wheat lines with improved flour quality. Local wheat variety *Bardosh* was used as object of our study. The *pHG-8_Glu_RNAi* constructs, which were designed on the basis of the main genes responsible for superior flour quality, were used to transform wheat plants by Agrobacterium tumefaciens.

To obtain wheat seedlings used for transformation, 40 seeds of the desired varieties with controls, were sterilized by soaking in 70% ethanol and 3.0% sodium hypochlorite, then washed with sterile distilled water and planted on moistened filter paper in Petri dishes and kept under conditions darkness at a temperature of 22°C for 1 day. At this stage, roots and shoots were emerged. Then, on the meristematic part of the seedling, it was pierced twice to a depth of about 1 mm with a needle, where 5 µl of a bacterial suspension of agrobacteria was dropped. Thereafter, the transformed seeds were placed on wet sterile vermiculite in a closed container and incubated at 22°C for 2 days, after which almost all inoculated seeds were germinated. After 72 hours, the transformed seedlings were placed in a solution of kanamycin 250 µg/l for 2 hours, next the seedlings were washed several times with sterile distilled water, placed in sterile containers on sterile vermiculite and kept in a refrigerator at +4°C for 25 days. At the end of the vernalization period, the genetic transformed wheat seedlings were transferred to pots with soil.

During the following experiments, wheat samples and their T1 generation will be studied and performed PCR analysis to determine the transgenic wheat lines.

CHANGE OF THE PRODUCTIVITY AND QUANTITY OF STRUCTURAL ELEMENTS OF DURUM WHEAT (*TRITICUM DURUM* DESF.) GROWN UNDER DROUGHT CONDITIONS DUE TO THE INFLUENCE OF TRICHODERMIN

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Drought is one of the factors that negatively affect the productivity and quality of agricultural crops. Recently, as one of the ways to solve this problem, fungal preparations are used to stimulate the growth and development of plants and to increase the tolerance to biotic and abiotic stresses of the environment. From this aspect, trichoderma is one of the most studied micromycetes. They stimulate growth, improve nutrient absorption, increase resistance and are an effective way to fight pathogens. This feature is related to the metabolites they synthesize. Therefore, the effect of trichoderma on the yield and amounts of structural elements of the hard "Goytepe" wheat genotype (*Triticum durum* Desf.) in drought conditions was studied. The experiments were carried out in 2022 (spring planting). The seeds of experimental plants were soaked with trichodermin for 15-19 hours before sowing. Fertilization was carried out during sowing, bushing and spiking phases. Irrigation was carried out at the beginning of bushing and spiking, and once at the end of bushing in the case of drought. Phenological observations were made from the time of sprout formation to the full ripening phase. During the period of physiological maturity, 10 spikes were selected and spike elements were determined. After harvesting, the mass of 1000 grains were determined and the productivity was calculated according to the sheaves taken from a single area.

It has been determined that trichoderm has a stimulating effect on the length, wet and dry weights of aerial part and roots of durum wheat under both conditions, drought and normal environment. The positive effect of trichoderma is also manifested in the increase in the amounts of photosynthetic pigments. Thus, compared with the drought variant, the amount of chlorophyll a was 10.12%, the amount of chlorophyll b was 7.24%, and the amounts of carotenoids was 8.31% higher in plants, the seeds of which were soaked with trichodermin and cultivated in drought. In drought, compared to the control, the length of the ear is 1.7 cm, width - 0.33 cm, the number of spikelets in the spike is 3.9, the mass of the spike is 1.02 g, the number of grains in the spike is 12.5, the mass of the grain in the spike is 0.39 g, the mass of 1000 grains are 5.4 gr.

and the productivity in 1 m^2 decreased by 51.5%. In drought conditions, the positive effect of trichoderma on the morphophysiological indicators of durum wheat variety was also shown in plant productivity and amounts of structural elements. The length and width of the spike, the number of spikelets in the spike, the number and mass of grains in the spike, the mass of 1000 grains, and the grain yield per 1 m2 increased compared to the control. Compared to the control, due to the influence of Trichodermin, the spike mass increased by 11.2% in the control + Trichodermin variant, the grain mass in the spike increased by 4.2%, and the productivity per 1m2 increased by 6.0%. These indicators were 57.7% in the mass of the spike, 34.3% in the mass of the grain in the spike and 36.9% in the productivity of 1 m^2 in the drought + Trichoderm variant compared to the drought variant.

Thus, in addition to improving the development of roots and stems of the plant under drought conditions, trichoderm also positively affects the amounts of photosynthetic pigments, which results in an increase in productivity. In other words, trichodermin can be used to reduce the negative impact of drought on the development of durum wheat varieties.

SPECIES COMPOSITION OF MYCOBIOTA OF ALMOND PLANT CULTIVATED IN ABSHERON-KHIZI ECONOMIC DISTRICT OF AZERBAIJAN

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The almond plant (*Amygdalus communis* L.), which contains high biological value, is distinguished by its medicinal value and the basis of people's diet, has a great impact on the country's economy with its import and export value. According to the information provided by the State Statistics Committee of Azerbaijan, almond cultivation in the Republic of Azerbaijan was 495.7 ha in 2016, and in 2021 this number increased to 2804.7 ha. 910 ha of this result belongs to Absheron-Khizi economic district. Increasing the yield obtained from almond trees are planted every year, identifying the conditions that lead to a decrease in productivity, and developing methods of combating these conditions are among the important tasks of today. Diseases caused by various organisms, primarily fungi, in almonds can reduce biological productivity and change the morphological appearance of almonds, as well as taking into account the influence of biotic and abiotic factors, the annually changing ecological environment, anthropogenic factors and the planting of new varieties of mushroom species brought from outside are one of the main sources that cause changes in the quantitative and qualitative indicators of the produced product. In order to be able to plan and implement the methods of combating these diseases, the identification and spread of the disease agents are among the main tasks ahead. 42 species of fungi were identified in almond samples taken randomly from different almond orchards of the Absheron Peninsula. 54.8% of studied fungi are representatives of Basidiomycota, and 45.21% are representatives of Ascomycota. The fungi belonging to the division Basidiomycota belong to 2 classes - Agaricomycetes və Pucciniomycetes, and the fungi belonging to the division Ascomycota belong to the classes Dothideomycetes, Eurotiomycetes, Leotimycetes and Sordariomycetes. The studied fungi are characterized as true biotrophs, true saprotrophs and facultatives according to their eco-trophic relationships, monomitic, dimitic and trimitic according to the structure of their hyphae, and white and brown according to the color of the decay they cause. For example, *Fomes fomentarius*, *Armilaria mellea*, *Inonotus hispidus* belonging to Agaricomycetes class belong to true biotrophs, *Fotipsis cyticina, F.pinicola, Ganoderma applanatum, Laetiporus sulphureus, Phellinus igniarus, Pleurotus ostreatus, Schizophyllum commune* belong to facultatives, and *Trametes*

versicolor, Trichaptum biforme belongs to true saprotrophs. 81% of the fungi belonging to the division Basidiomycota produce white rot and 19% brown rot under natural conditions. 2 species of fungi belonging to the Pucciniomycetes class belong to true biotrophs due to their eco-trophic relationship and cause rust disease in the host plant. Some of the fungi belonging to the division Ascomycota are anamorphs, while others are telemorphs.

MIGRATION OF POLLUTANTS IN WASTEWATER

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Wastewater is one of the main factors of environmental pollution. Wastewater dissolves all toxic compounds contained in water and migrates into soil, water, animals, plants, food substances in a mixed form and eventually enters the human body. Migration of chemicals and their concentration in groundwater increases as a result of human activities (agriculture, industry, construction, etc.). At the same time, substances of anthropogenic origin enter the natural environment, as well as water. In many cases, they are alien to this environment, sometimes toxic and have unfavorable properties. The total amount of pollutants in groundwater and river waters reaches several thousand. The main sources of pollution of natural waters are industrial and domestic wastewater.

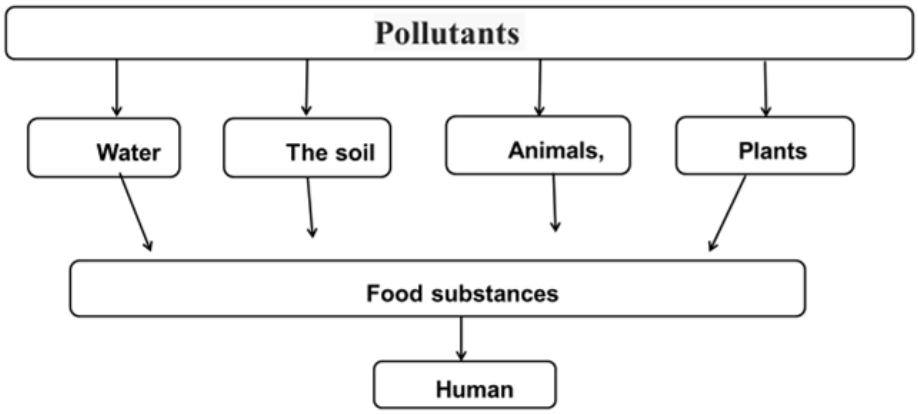
The main indicators of pollution of natural waters are: 1. Dissolved oxygen. Good water quality depends on the amount of dissolved oxygen. 2. Indicator of biochemical oxygen demand. The higher the score, the greater the pollution and the lower the water quality. 3. The presence of microorganisms in the water. An indicator of microorganisms is the number of intestinal bacteria (calitre). 4. The amounts of nitrites, ammonia, nitrates, oil and oil products, phenol, surfactants, heavy metals in wastewater.

The occurrence and growth of diseases depend on the nature and degree of water pollution. Poor drinking water quality is the cause of 60% of diseases in the world. Every year, 24 million people in developing countries suffer from diseases caused by drinking water contaminants and pathogens. There are 2 main groups of sources of pollution of water resources: diffuse sources of pollution and point sources of pollution.

Group I: treatment facilities for household and industrial wastewater.

Group II: Water pollution by decomposition products of fertilizers and pesticides used in agriculture. Water pollutants and their indicators can also be divided into several groups. The diagram below shows the migration pattern of contaminants.

Scheme of migration of pollutants



A group of pollutants creates certain problems for water quality in various reservoirs and requires an appropriate control strategy.

PLANT ANATOMY AND MORPHOLOGY

MORPHOGENESIS OF JUVENILE PLANTS OF SPECIES *PUYA MIRABILIS* (MEZ.) L.B. SM.

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The family *Bromeliaceae* Juss. has its own place among the tropical and subtropical plants used for the improvement and landscaping of the internal ecological environment in recent years. According to *World Flora Online* and *The Plant List* databases, the family *Bromelia* includes 3320 species belonging to 55 genera. Most species are epiphytic plants and endemic to America. The genus *Puya* of the family includes 227 species. It is mainly distributed in arid regions, mainly in the Andes.

P. mirabilis L. B. Smith. is a perennial, terrestrial, underground rhizome rosette plant. Its height is 20-25 cm, the diameter of the rosette is 40-45 cm. Numerous (35-40) leaves are linear, long, green in color. The length of the floral axis reaches 130 cm. The flowers (9-11 pieces) collected in a racemous inflorescence are large and green in color. It blooms in October. Produces seeds. It is easily propagated by seed and side shoots. It is not very demanding in culture. Its homeland is Central and South America.

The main goal of the research was to study the morphogenesis of juvenile plants of *Puya mirabilis* under greenhouse conditions. From the conducted experiments, it was known that the seeds of *P. mirabilis* begin to swell 3-4 days after sowing and are already visible to the naked eye on the seventh day. This plant is characterized by the above-ground type of germination. Seed germination begins with the bursting of the bark, and the embryonic root (0.1-0.7 mm long) that initiates embryo leaflet and the primary root emerges with the hypocotyl. Its seed lobes cover the embryo shoot with their ring-shaped base, and the tip remains in the seed coat for a long time. The resulting sprout develops very quickly. A few days after the formation of sprouts, the growth of the main root stops and gradually dies, as a result, lateral roots begin to develop.The sprouts of the plant enter the juvenile phase after 9-14 days. Juvenile plants are up to 0.4-0.6 cm tall and up to 1.1 cm in diameter. The leaves are oblong, light green, 0.2-0.8 cm long and 0.2-0.17 cm wide. As a result of the failure of the epicotyl and the next internode to develop, a rosette-type sprout begins to form. A rosette consisting of 6-8 leaves, 0.5-1 cm long, with a more or less well-developed root is formed in the plant. The young plant enters the immature phase after 2.5-4 months.

Immature plants are about 2-2.3 cm tall and 4.2 cm wide. The leaves are up to 10-14, oblong, green, up to 1.3-2.7 cm long and with 0.2-0.5 cm wide soft green spines. The main root is destroyed and additional roots up to 3.8-4.1 cm in length develop. The immature phase lasts 1-1.6 years. Virginil plants have rosettes up to 9-12 cm high and 12-15 cm in diameter. The leaves forming the rosette are 6-14 cm long and 0.5-0.7 cm wide at the base. The spines on the leaf are green, more or less hard. The root is fasciculated and well developed. The virginal period of the plant lasts 2.2-3.1 years. The 4th, 3rd and 5th year of plant development goes into the young generative phase of the generative period. At this time, the height of the plant is up to 14-18 cm. The spines on the leaf are reddish in color near the base. The plant blooms for the first time in the young generative phase.

As a result of the researches, it was determined that in greenhouse conditions, the *P. mirabilis* plant has a period of relative rest in the months of October-April, and the maximum growth is observed in the months of July-August. Then the growth process gradually decreases, and starting from November, the plant goes into a period of relative rest, which lasts until March-April.

In species *P. mirabilis*, the growth and development of the vegetative part ends with the beginning of generative development. The development cycle of the *P. mirabilis* plant from seed to seed takes place within 5-6 years.

According to the obtained results, *P. mirabilis* species can be recommended for use as an exotic plant in winter gardens, in phytodesign of interiors, and in greening the interiors of buildings used for various functional purposes.

MORPHOLOGY AND GEOGRAPHICAL DISTRIBUTION OF *PISTACIA VERA* L. IN UZBEKISTAN

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Pistacia vera L. is a small tree or shrub-shaped plant belongs to the family *Anacardiaceae. Pistacia* L. has a economic importance (especially *Pistacia vera* L.) which a yield of $ 2 billion per year is obtained from it.

Pistacia vera L. (Pistachio) is a dioecious tree with the length of 7-10 meters. The annual branches are gray with a rough bark, the young branches are smooth red-brown. The buds are small, pointed, and dark brown. The leaves are 3-5 leafy odd-patchy, and ovoid in shape. The action of aphids on pistachios begins in early spring. Flowering begins at the end of March or in the first half of April. Androtsey blooms 2-3 times earlier than genetsiy. Since early and late forms are found on wild plantations, the flowering period lasts about 15 days. *Pistacia vera L. grows mainly on mountain slopes and hills; sometimes also grows in valleys in the form of individual specimens from time to time.* In Central Asia, pistachios grow mainly on the northern, western, and eastern slopes, in mountains 2000 m above sea level. This plant achieves its best development at an altitude of 600-1200 m above sea level. In this zone, 200-350 mm of precipitation is usually observed per year, which can be considered sufficient moisture for the pistachio plants. Pistachios require high temperatures and are very tolerant of cold winter temperatures. In the Central Asian region, the temperature drops to -32.8°C in winter, and in summer it sometimes reaches + 42.6°C. Concerning light, pistachio can be described as a light-loving plant. Pistachios never form a dense forest. Pistachios are very rare on the territory of Tajikistan.

The pistachio plant originally originated in western, central, and Asia Minor and spread from Syria towards the Caucasus and Afghanistan. Archaeological finds in Turkey suggest that handon pistachios were consumed as early as 7000 BC as walnuts. *Pistacia vera* L. was introduced to Italy from Syria in the 1st century AD, then began to be cultivated in America. In other regions of Uzbekistan, pistachios are distributed only in individual trees or groups. In this form, it is known that it is distributed in the southwestern foothills of the Hisor Ridge, in the Nurota Mountains, at the western tip of the Turkestan Ridge, and in the southwestern foothills of the Tashkent Olotog. In Kyrgyzstan, pistachios are distributed in Jalalabad Forestry, Suzak tract (Koğar dacha), and on the road from Bozarkur to Chorvak, Qiziljar Forestry, Khoja ota, north of Aflotun village. Along the slopes of Talas Olatovi, pista passes into Kazakhstan. Most often this species is found on Matbalskaya and today-Boroldaevskaya dachas.

BIOMORPHOLOGICAL CHARACTERISTICS AND IMPORTANCE OF *PRUNUS COMMUNIS* DISTRIBUTED IN FLORA OF NAKHCHIVAN AUTONOMOUS REPUBLIC

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The geographical location, relief features, soil and climate factors of the Nakhchivan Autonomous Republic have led to the creation of special vegetation here. One of the main natural resources of this region is its rich vegetation. According to the literature data, woody species of *Rosaceae* family distributed in the flora of Nakhchivan AR occupy a special place. During the comparative analysis of collected factual materials and literature sources, it was determined that 8 species of *Prunus* L. genus of *Rosaceae* family are found in the study area, of which *Prunus communis* species is widespread. On the basis of research conducted in Nakhchivan AR at various times, detailed information was obtained about the biomorphological characteristics of *Prunus communis* species and mainly the prospects of use. The use of the species in the treatment of some diseases in folk medicine has further increased the interest in this plant.

Prunus communis - 2-8 m tall tree or shrub with thornless branches and gray bark. The branches are sometimes thorny. At first, young shoots are reddish-chestnut, and later they become gray-brown in color. The leaves are lanceolate or elliptic, sparsely hairy or glabrous, the tip is obtuse or acuminate, the base is broadly wedge-shaped, the stalks reach 3 cm. The single flowers are short stalked or sessile. Petals are mostly white or pink in color, 1-2 mm long and 1.2-1.5 mm wide. The fruits are oblong, ovoid or elliptic in shape. The kernel is elliptical, smooth, and varies in color from white to brown. The fruit is a one-seeded, stone fruit. The pericarp is dry, green, felty, easily separated from the kernel when ripe. The kernel is hard, the seed is egg-shaped, compressed from the sides, covered with a thin brown membranula, the seed-lobe is bitter. Two almonds are cultivated for the taste. Sweet almonds and bitter almonds. It is found in most regions of Nakhchivan AR.

Common almond is one of the plants with great benefits for human health. According to many researchers, almonds have the property of lowering the amount of cholesterol in the blood. Almonds contain 54% fat, 16.9% starch, and are very rich in vitamins. Its composition is rich in vitamins A, B, C, E, magnesium, iron, calcium, phosphorus, carbohydrates, and potassium.

Almonds are a source of omega 3, the vitamin E in its content strengthens bones and lowers the risk of diabetes. Calcium in its composition prevents bone loss, and magnesium prevents headaches, insomnia, fatigue, and

dizziness. As almonds are strong antioxidants, they increase the body's immunity and regulate growth and development. As it is rich in vitamins, it strengthens the ability of taste and smell in mothers who use it during pregnancy. It is also known to science that almonds prevent diseases of the cardiovascular system. People who eat at least 4-5 almonds in their weekly diet are less likely to have heart problems. Since the fats it contains make people feel full, they also help to shed excess body weight while eating. Studies have found that almonds play a positive role in removing gallstones.

Sweet almonds are widely used in the confectionery industry and eaten fresh. Honey is collected from its nectar and pollen. In addition to being a valuable melliferous plant, it is widely used in decoration and soil formation. In medicine, sweet almond is also known as a pain reliever, sedative and tonic. Oil from fresh sweet almonds is used against sunburn. In the light industry, it is used in the preparation of beverages, including chocolates, as well as in various dishes.

Bitter almond is a plant rich in magnesium, phosphorus, iron and calcium. It has many benefits for the body. It is used to prevent cough, clean the lungs, treat heart diseases, regulate the amount of sugar in the blood, remove gall stones and diabetes. Bitter almond is also used as a cosmetic for skin cleansing. Bitter almond oil is used in the preparation of medicinal preparations injected under the skin and camphor, as well as for the production of ointments and emulsions. Activated charcoal is also obtained from bitter almonds.

Thus, the above mentioned does not fully reflect all the important species of the genus *Prunus.* In our future studies, it is considered appropriate to comprehensively study all promising species of the genus.

MORPHOGENESIS FEATURES OF THE GENERATIVE AND VEGETATIVE BUDS (*PADELLUS MAHALEB* L.) IN ABSHERON CONDITIONS

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The aim of current work was to study morphogenesis of generative and vegetative buds of *St. Lucie* Cherry (*Padellus mahaleb* L.) introduced in Absheron The studying and revealing the characteristics of morphogenesis of *Padellus mahaleb* L. bud, introducents in their new soil-climatic conditions, which include and Absheron peninsula, that is characterized by dry semi-and subtropical climate and vegetation type: It was established that the generative and the vegetative buds of during *St. Lucie* Cherry a determination phase and in further differentiation were exposed to qualitatively and quantitative changes.

The morphological observations were carried in accordance with the methodology developed in primary Botanical Garden of Russia during the per vegetation period in the following phases: the beginning of buds swelling, the beginning of leafing after every 2-3 days, but only in spring and after days. the beginning of buds swelling, the beginning of leafing after every 2-3 days, but in spring and in high season after days**.** Prepared samples were investigated in flumo scope microscope and the pictures were taken by the AM7023 camera.

Vegetative and generative buds of *St. Lucie cherry* introduced in Absheron, were laid in the year preceding flowering and were formed, from the stage of meristematic tubercle until whole development within 10-11 months. So, it's necessary to conclude that, *St. Lucie cherry* introduced in Absheron consistently underwent normally all stages of its vegetative and generative development (morphogenesis of vegetative and generative buds, floral, inflorescences, flowering and fructification) therefore this species is considered to be a promising decorative and fruit plant for Absheron. The duration of differentiation of generative buds was on average of 233 days, but for vegetative buds this period was 217 days. The study of the various stages of development of the external and internal structures of *St. Lucie* Cherry buds allowed to give the following description. It was established that, its flowering menoecious plant has 3 types of buds mixed with vegetative, generative and subsequent arrangement.

BIOMORPHOLOGICAL CHARACTERISTICS OF SOME RELICTS AS THE THIRD ARCTIC FLORA OF AZERBAIJAN

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Relict plants are rare plant species that have survived over from the Tertiary geological period. These plants were very widespread in the world 35-70 million years ago, but later became extinct during the great glaciation. Currently, some of these plants can be found in some temperate subtropical zones of the Earth.

The Caucasus, especially the Eastern Transcaucasia, occupies one of the significant places in the world flora due to its rich plant diversity. Some rare relict plant species from the tertiary arctic flora can be found here. These plants play a special role in the formation of forests in the Talish region of Azerbaijan.

Talysh forests, rich with relict trees and shrubs, were protected from the negative effects of the Great Glaciation due to being surrounded by high mountains in the south and the Caspian Sea in the north.

The following plant species up to the third Arctic flora are found in the flora of Azerbaijan: *Parrota persica* L., *Platanus orientalis* L., *Ficus carica* L., *Punica granatum* L., *Albizia julibrissin* Dur., *Gleditschia caspia* L.

Hamamelidaceae R.Br. family includes approximately 80-90 species belonging to 27 genera distributed in tropical, subtropical and temperate zones of the Earth. The representatives of the division are trees and shrubs according to their life forms. The leaves are simple, falling, alternately arranged. Leaf axils are entire or finger-shaped, leaf bases are star-shaped and covered with dense hairs. The flowers are bisexual, with heads, the leathery sepals are bell-shaped, attached to the ovary from the bottom side; the cup has 5-7 slices, without petals. The number of stamens is 5-7, located in front of the slices of the calyx. Ovary is semi-substrate, two-lobed; nests are one-seeded; simple mouthed teeth with two columns. The fruit is a woody capsule that opens with two flaps.

Platanus orientalis L. – is a oriental plant tree, which belongs to the genus of the family Platanaceae Lindl.

There are 11 species of sycamore in the world. These species are distributed in temperate regions of North America and Asia. A species grows wild in the Caucasus. Cultivated 4 species. In Azerbaijan, one species - the eastern sycamore grows naturally.

Platanus orientalis L. is a large tree with a broad canopy, 25-35 m tall, and rarely up to 50 m. The diameter of the trunk is 2-5 m, and sometimes 12 m.

The bark of the trunk and branches is greenish-light gray, dull-light gray or yellowish-greenish in color. The shoots are wide-conical, swollen, arranged alternately in long cones. The leaves are deciduous, simple, arranged alternately, with 5-fingered lobes, 15-18 cm wide and 12-15 cm long. Sometimes it is slightly wide-cordate at the base. Stems are reddish, 5-8 (15) cm long, white felt-like hairy when young. Later, it becomes naked, the rule part is wide and covers the body. The fruit heads are 2-5 (7) pieces, located on a general recumbent stem and hairy, large, 2-2.5 cm in diameter. The fruits are seed-like, the top is widened and pubescent, changing into a long straight, glabrous column 4-5 (7) mm long. It blooms in April-May, bears fruit in September-October. The fruit heads remain on the tree during the winter and are shed in early summer the following year.

It is propagated by seeds, cuttings, cuttings and stem grafting. Eastern sycamore is a light and heat-loving, soil-demanding plant.

STRUCTURAL FEATURES OF POMEGRANATE (*PUNICA GRANATUM* L.), GROWING IN AZERBAIJAN

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Microscopic researches have shown that a stalk of *Punica granatum* L. on the cross section is of a four-angular form. On epidermal section cells are single-core, on paradermal section cells are linear. There is 1-2 row of polyhedral form of cell from pul to the inside with physiological active substance tannins. The core consists of 5-6 rows of parenchyma cells. In stalk chlorenchyme locotes from core into inside and borders with phloem. Naturally, such structure creates condition for tannins and for intensive formation of organic substances. The main part of a stalk is carrying-out tissue. The number of beams is xylem is 30-35 pieces, in each, beam there are 8-10 pieces of vessels. Phloem mainly settles outside from xylem and consists of 6-7 rows. From xylem to the center has developed 2-3 layers phloem cells, which borders with central cylinder. The cylinder cells are round, big and densely settled down. Among these cells we can meet a special cells which occult rate tannins substance. The structure of central cylinder is unbunch.

The leaf on a cross section has dorsoventral structure. The epidermal cells are tightely closed without intercellars. The cells of upper and lowes epidermis are covered with small tuberous cubicle. The cells of upper peel are big and thickened. Stoma of anomocytic type is settle on lower epidermis. The palisade parenchyma is 1-rowed and rich with chloroplast. Carrying-out bunch are collateral type. The outside is surrounded with are layer of cell. Xylem is in upper side, phloem is in lower part. The vessels in xylem are settled one after another and from 5-6 pieces of vessels. Phloem consists of 4-5 rows. From phloem to outside are 2-3 rows of sclerenchyma cells and it makes the leaf flexible and increases it`s firmness.

The microscope section of side roots witch diameter from 0,2 to 15 mm has showed that it consists of central cylinder tissues, as a totality of carrying-out tissue, also tissues of core part and cover tissue-cork. The total outline of root on cross section, as a rule, is round. The cover and bark parts occupy 20-30% in he structure. In cross section and it depends on diameter of root. The most strong part is xylem of central cylinder.

In the cells of bark we can observe the accumulation of tannins substances.

It was revealed, that well-developed carrying-out tissue, formation and accumulation in cells of tannins substance, the location of chlorenchyme on border with phloems, after bark in stalk, after wards formation of phloems and xylem and it serves to characterize the diagnostic feature of this type.

MORPHOLOGY AND DISTRIBUTION OF THE SPECIES *ALNUS SUBCORDATA* C.A. MEY.

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Alnus subcordata C.A. Mey. - Caucasian alder, is one of the common species of *Alnus* genus belonging to Betulaceae family in Azerbaijan. The Caucasian alder is a straight-stemmed tree that can live for over 200 years under favorable conditions, reaching a height of 28–30 (35) m and a diameter of up to 160 cm. The bark of young trees is light gray with whitish spots on it, the bark of old trees is dark gray and several curved longitudinal cracks are visible on it. The pods are hairy, reddish-brown in color, with thin and light-colored lentils. Shoots are on peduncles, hairy and ovate, with blunt ends. Leaves are rather large, 7–17 cm long and 4.5–7 cm wide, ovate, round-ovate, oval or oblong-oval, tip pointed or pointed, base more or less cordate or round, sometimes sides subequal in length, margins subequal to toothed, almost equally toothed, slightly glabrous, glabrous, dark green above, pubescent along the veins, and with tufts of hair at the angles of the veins; lateral veins (6) 10–11 (13) pairs. The length of the stems is 1–3 cm. Stamen ears are in clusters at the end, 3–5 of them together. Pollinated by wind: Fruiting ears emerge from axils, solitary or 2–3 together; cones are oval-elliptical, 2.5 cm long and 1.3 cm wide. Nuts are wide ovoid, with very narrow wings. In its sprouts, the kernel leaves are slightly raised, small and oval in shape, the edges are saw-toothed; the veins of the underside are red; petioles adpressed to the stem, narrowly lanceolate, up to 3 mm long; the body is red and sparsely hairy throughout. Flowering occurs in April, and fruiting occurs in October-November.

Its wood is dense, reddish, waterproof, suitable for turning and carpentry products. The resinous green cones are used to make chewing gum, and the bark is used to paint fabrics. Like other species of the genus, heart-leaved alder is of particular importance as a valuable ornamental tree.

The Caucasian alder is common in the territories of Lankaran and Lerik regions in Azerbaijan. In the area from the lower to the middle mountain belt, it is found up to 1000 m above sea level, rarely in the plains. It grows on the banks

of rivers and creeks, as well as in forests in humid mountain valleys, forming small area forests on river terraces.

Alnus subcordata is a rare, relict species of Azerbaijan. It is included in the Red Book of the Republic of Azerbaijan in the category of vulnerable to extinction (VU).

THE MORPHOLOGY AND DISTRIBUTION OF THE SPECIES *TEUCRIUM POLIUM* L.

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It was mentioned in the multivolume collection of flora of Azerbaijan that 8 species of the genus Germander (*Teucrium* L.) belonging to the family Lamiaceae or Labiatae are spread in Azerbaijan. Species belonging to the genus *Teucrium* L., rich in essential oils, are decorative and have nutritional and medicinal value. The species *Teucrium polium* L. - Felty germander, was used as a medicinal plant for various diseases in Eastern Europe in the 16th century and cultivated in gardens. It is an important plant with essential oil and medicine.

Teucrium polium is a cushion-shaped perennial plant in semi-shrub form, woody or thickened root, multi-branching underground spear; rising from the base and not infrequently very wrinkled, rarely grows upright at 5-(25,35,40) cm in height, cylindrical, firm, less dense or dense short and densely piled type of pubescence, whitish, pale or sometimes snow-white, yellowish or reddish (especially in the lower part), with short broom-shaped or, in most cases, shield-like hairs in the upper part, with a joint of very different lengths. Leaves often equal to the length of the petioles, 2 times as long or 2 times shorter than them, 0.5-3.5 cm long, 1.5 mm wide, ruler-shaped, inverted or elongated, conical at the base, obtuse at the upper part, edges long, denticles with not deep blunt denticles along the edges or in the lower part (2/3—1/3) full-sided, in very frequent cases with folded-over edges, slightly wrinkled, sessile in rare cases, same type of pubescence as on body on both sides, but denser below, green or yellowish above, greyish-whitish or whitish below. The flowers in the pseudobulb are numerous on the stem and at the ends of their branches, in small numbers arranged on short flower stalks, very close to the pseudobulb, cap-shaped, dense, balloon-shaped or ovoid, 0.8-2 cm in diameter; leaves with floral base not large, subequal to flowers or shorter, 3-5 mm long, ruler-shaped or linear-partite, with whole edges, folded edges, pilose pubescence type; flowers almost sessile, 5-8 mm long, whitish or yellowish; calyx short tube-bell-shaped, densely whitish or white pilose, grooved-wrinkled, almost identical, short triangular, much shorter than the tube with obtuse denticles, covered with fur, whitish, externally piled corolla slightly longer than calyx, the stamen is slightly out of the flower. Nut length is 1.5-2 mm, net-shaped and wrinkled. Flowering covers the months of May, June, July, August and sometimes September.

The white chickpea species is distributed all over Azerbaijan, from the lowland to the middle mountain belt, in dry, clayey and stony slopes, cliffs, sand dunes, rocky places, arid hills, rocks, outcrops, areas where the lower chalk layer is exposed, bushes and wormwood semi-deserts.

Teucrium polium species materials were collected in June and July 2021 in Grizdahna village, Guba region, on the road to Griz, Kuzun village, Gusar region, Shahdag recreation center area, in July 2022, on stony, rocky, dry slopes on the river bank in the area of Cheshmali village of Tovuz region, Yukhari Amburdara of Lerik region, Ivanovka of Ismayilli region.

COMPARATIVE MACROSCOPIC AND MICROSCOPIC ANALYSIS OF MORPHOLOGICAL AND ANATOMICAL CHARACTERISTICS OF MEDICINAL PLANT SAMPLES FROM DIFFERENT ECOLOGICAL GROUP

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In our research work, samples of pharmaceutical plants from different ecological groups were taken from the territory of Goygol district of our Republic. Here, analyzes were made on ecomorphs from the xerophyte, mesophyte, hydrophyte and hygrophyte groups. *Polygonum aviculare* L. species is xerophytic and an official medicinal plant included in the pharmacopoeia. The plant contains essential oil, mainly anthocyanins, ascorbic acid, coumarin, phytoncide, etc., in scientific medicine and folk medicine, antioxidant, anthelmintic, kidney, bladder, liver, pulmonary tuberculosis, skin, tumors, gout, babasil, hypotensive, hemostatic, astringent, vasodilator, etc. are used. The species *Polygonum aviculare* belongs phytogeography cally to the holarctic class of the boreal type

Due to its ecomorphic condition, the morphological and anatomical characteristics of the hygrophyte (hygromesophyte) *Polygonum hydropiper* L plant were also studied. Due to its biologically active substances localized (alkaloid, many vitamin groups, saponin, coumarin, flavonoid, essential oils, carotenoids, tannins, steroids, organic acids, microelements, macroelements, sesquiterpenoids and others), this species has high pharmaceutical properties. It is widespread in the territory of our republic. In the root system of *Polygonum hydropiper* plant, sufficient vaccine and anthroglucosides are collected. In scientific and folk medicine, eczema, asthma, kidney stones, stomach ulcers, etc. It is used for the treatment of diseases. Due to these high indicators, the species is an official medicinal plant included in the pharmacopoeia. In addition to scientific practical experimental pharmacological studies, *Polygonum hydropiper* species is also involved in anatomical studies.

Achillea clypeolata L. which belongs to the mesophytic ecological group due to its floristic position, contains flavonoids, essential oil (containing azulene), bitter glycosides, vaccines, etc., and is used in pharmaceuticals as a choleretic, as a wound healing agent, and as a choleretic agent. By involving this plant in microscopic analysis, we determined the characteristic structure of the tissues in its vegetative organs and in which tissues the endogenous secretory sites are formed. Taking into account the ecological characteristics of the *Sagittaria sagittifolia* L plant, we studied the anatomical structure of this

species, which is hydrophilic, and determined the different indicators of the plants belonging to the xerophyte, mesophyte and hygrophyte groups. *Sagittaria sagittifolia* contains more teoglycosides. In the leaves of the species whose anatomical structure we studied as a vegetative organ, the phenomenon of heterophilia is also observed as a physiognomic process. The entire biomass of the plant is used for medicinal purposes. The plant contains theoglycosides, monosaccharides and other biologically active substances.

As a result, we can note that according to the ecological approach, according to the relation to humidity, plants are anatomically different in structure as hydrophyte, hygrophyte, mesophyte and xerophyte according to their living forms in relation to the external environment. According to the function of the vegetative organs of the plants, the presence of a structure specific to each plant in different tissue groups was revealed by microscopic studies.

During the anatomical analysis, it was learned that the parenchyma cells of the plant sample belonging to the mesophyte group are larger. Parenchyma cells are located in xerophytes. the cell envelopes are relatively thickened.

MORPHOLOGY AND DISTRIBUTION OF *CAMPANULA GLOMERATA* L. SPECIES IN AZERBAIJAN

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Campanula glomerata L., 1753, Sp. Pl. 166; A. DC. Monogr. 253, p. p.; 1957, Ан. А. Федоров, Фл. СССР, 24:200; 2008, М.Э. Оган., Ш.В. Шванова, Консп. Фл. Кавказа, 3(1):140; 2016, A. Əsgərov, Az. bitki aləmi, 306 - clustered bellflower

The species *Campanula glomerata* L. belongs to the section Involucratae (Fomin) Charadze of the genus *Campanula* L. (Campanulaceae Juss.) It is described based on the materials of researchers from Sweden, France and England.

Lectotypus (Viktorov, 2002: 214): Herb. Linn., № 221.44 (LINN, photo!).

Heterotypic synonyms:
Campanula oblongifolioides Galushko
Campanula trautvetteri Fed.
Campanula glomerata subsp. *caucasica* (Trautv.) Ogan.
Campanula glomerata subsp. *oblongifolia* (K. Koch) Fed.
Campanula glomerata var. *caucasica* Trautv.
Campanula glomerata var. *oblongifolia* K. Koch

Distribution in Azerbaijan: Greater and Lesser Caucasus, in Nakhchivan mountain., Nakhchivan Highlands, Lankaran mountain., subalpine and alpine meadows, in the bushes, forest meadows and rocks in the taiga zone.

A plant with dense, woody, short rhizomes and brown fibrous roots. The height of the stem is about 15 (30)-50 (80) cm. dense or thin, straight, simple or weakly branched, indistinctly angular-lobed, usually reddish in color, covered with soft or rarely stiff but not spiny hairs and leafy. The leaves are thick, small semicircular, green on both sides but darker on the upper side, covered with hairs as on the stem or smaller, rarely glabrous, sometimes covered only along the veins. Rosette leaves and lower stem leaves are long-stalked, ovate-oblong or ovate-lanceolate, heart-shaped, oval or obtuse based, sharp or obtuse. Upper leaves are sessile, narrower and smaller, flat and sometimes the leaf embraces the stem. The largest leaves are 10 cm long and 3 cm in diameter. The flower group is truncate, narrow and unbranched, consisting of a dense head located at the top and thick axillary flower buds (sometimes quite numerous).

The calyx is lightly coated, green in color and has no appendages. The calyx is lightly coated, green in color and has no appendages. The teeth of the calyx are lanceolate, sharp and 3-4 times smaller than the tube-shaped crown. Corolla dark purple, glabrous inside or very weakly and shortly covered, 2-5 cm. in length, up to 1/3 of its length is divided into oblong-ovate, sharp or obtuse parts, the edges of which are ciliated.

Flowering and fruiting: VI-VIII months.

COMPARATIVE ANALYSIS OF MORPHOMETRIC PARAMETERS OF *ORCHIS SIMIA* LAM. AND *ORCHIS PURPUREA* HUDS. DISTRIBUTED IN DIFFERENT ECOLOGICAL CONDITIONS

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Recently, as a result of the intensification of the urbanization process, a number of representatives of orchids are in danger of disappearing, and some representatives continue to be found in habitats that are not suitable for them. Depending on the ecological conditions in which they are distributed, conducting research on the morphological parameters of orchids can play an important role in the use and introduction of orchids in urban parks.

Therefore, the morphometric parameters of *Orchis simia* Lam. and *Orchis purpurea* Huds. plant species distributed naturally in Altiaghaj and Gizilgazma villages of Khizi district were studied in a comparative manner.

Orchis simia Lam. and *Orchis purpurea* Huds., taken as research objects, are species of the *Orchis* L. genus of the Orchidacea family, and are considered tuberoid orchids. *Orchis purpurea* is also classified as rare and endangered. Along with anthropogenic factors, biotic factors have also played a significant role in reducing the number of this plant recently. Thus, the research work was carried out in April-May of 2022-2023 in the territory of two villages of Khizi district, GPS coordinates, air temperature (t-˚C), CO2 content (ppm) and humidity (R-%) of distribution areas of both plant species as well as ecological and morphometric indicators of plant were measured. The Khizi district is characterized by a mild hot climate with dry summers. Parameters such as height of plant (h/p), length of inflorescence (l/i), number of flowers (n/f), width of leaves (w/l) and length of leaves (l/l) were determined in morphological studies. Since the studies coincided with the flowering period of plants, morphological measurements were carried out on generative individuals. In the course of field studies conducted in 2022, the air temperature (t°) in the Altiaghaj and Gizilgazma areas of the Khizi district was 19.8°C-15.9°C (average monthly temperature 18.1^0C), the amount of CO_2 was 211-208 ppm, air humidity (R) - 65.6-83.9%. During field studies conducted in 2023, the ecological parameters of Altiaghaj and Gizilgazma villages were equal to t°-17.1°C and 14.4°C (average monthly temperature 16.6°C), CO_2-202 and 389ppm, R-68.8 and 74.2%. Comparison of the average values of the morphometric parameters of the plant showed that for the plant Orchis purpurea, common in Altiaghaj area, high values of the width and length of the leaf, the

number of flowers and the length of the inflorescence were observed in plants studied in 2023 (Σ: length of inflorescence (l/i) – 12.1 cm, number of flowers (n/f)-33, length of leaves (l/l)-10.9 cm, width of leaves (w/l)-4.5 cm). However, as a result of the analysis, it was determined that no very high level of variability was recorded in the morphoparameters of the lady orchis, which is spread around the village of Gizilgazma (h/p-32.5/32.8cm, l/i-6.6/6.6cm, n/f-44/37, l/l-13.1/ 9.2cm, w/l-4/4.5cm). An analysis of the morphological parameters of individuals of the species Orchis simia, common in the Altiaghaj area, shows that in 2023 it was higher (Σ: h/p-33.6cm, l/i-9.7cm, n/f-31, l/l-12.4cm). A similar situation was observed in individuals found in the Gizilgazma area (Σ: h/p-34.7cm, l/i-6.6cm, l/l-6.4cm, w/l-3cm).

From the research, it is concluded that the morphometric parameters of *Orchis simia* Lam. and *Orchis purpurea* Huds. plant species distributed in Altiaghaj and Gizilgazma areas of Khizi district were at higher values in 2023, and this is related to the changes in environmental conditions of that year. Compared to 2022, in 2023 the environmental conditions for both plant species were more optimal. In addition, the height and development of the plant may depend on the edaphic factors of the area and the characteristics of the mycobiota of rhizosphere of the plant.

RENTGEN-BASED TOMOGRAPHY IN THE TREES

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The Republic of Azerbaijan as well as the territory of the Institute of Dendrology is opulent with an excessive number of tree species. Despite of the fact that these trees which are over a hundred years old, charm people with their outer stances, climate variations and change and also some ecological factors observed in the environment, triggers the process of decay in them. Nevertheless, the sequence of the processes within the plants and the damage levels can be ascertained via tomographic analysis by transmitting electrical impulses which aim to prevent decay processes that are developing within the certain plants. By identifying the core impacts and other environmental factors that cause deterioration within the plant throughout the years, we can eliminate the mainsprings that impede the growth of the plant by engendering malady in it. Eventually, this will help the trees to have a sturdy trunk as well as a longer lifespan.

In order to assess the location and size of defects inside of the tree trunk, 2D imaging tomography equipment (Arbotom®) by Rinntech (Heidelberg, Germany) have been used. The electrical impulses were transmitted to the tree stems via the aforementioned apparatus and the procured results were conveyed into a computer by a specific software. The major feature of the above-stated device is that it does not cause any harm to the tree, on the contrary, it predicts any deterioration within the trunk of it. Various colorful lines which show sensitivity of different stress waves that are being obtained from Arbotom®, display the defectiveness. To ensure the optimal quality via Arbotom® software, we can utilize two-step filter which detects the rottenness in advance and so precludes any possible ravage of the tree. By detecting the discrepancy of radial and tangential motion velocities, Arbotom® standardizes and reflects them on the tangential graph.

Via annexing values into the tangential graph, the affecting parameters to the tree species are being evaluated (Anonymous 2005). The position of a stress wave in each tomography pixels was carried out based on a specifically designed programme by the utilization of Borland C ++ device (Borland, Texas, USA). Subsequently, the tomogram was forwarded into an excel file (Redmond, California, USA).

Via tomographic analysis by transmitting electrical impulses which aims to prevent decay processes that are developing within the certain plants, we can assuredly save in abundance of lives in the mother nature ere it is at the breaking point. Contemplating the pervasive impacts of the trees on human welfare and natural equipoise, it is our paramount duty to protect and take care of them and Arbotom prominently conduces toward the actualization of this sublime mission of ours.

FUNCTIONAL STATES AND STRUCTURAL LABILITY OF BIOLOGICAL MEMBRANES

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A classification of plasma membrane permeability modifiers is made based on the characteristics of changes in electrophysiological parameters against the background of exogenous influence on cells. However, relatively little space has been devoted to the study of the lability of its electrical capacity, which is an indicator of its structure and polarization state. This is primarily related to a number of problematic aspects of the measurement of that quantity. On the other hand, in classical reviews devoted to the analysis of research materials in this field, that quantity was presented as an absolute, unchanging characteristic of biological membranes. However, the improvement of the research technique revealed the lability of that quantity as an indicator of the structure-polarization state of the plasmatic membrane. A large-scale study of these facts opens wide opportunities for screening the relationship between functional states and structural lability of biological membranes in both *in vivo* and *in vitro* studies. For this purpose, the application of standard modifiers of the transport properties of the plasmatic membrane as an exogenous factor can be a successful step for the identification of structural-polarization changes caused by them.

At the initial stage of our experiments, we also determined the important point that the share of lipid and protein phases is of special importance in the change of the state of structure-polarization of the plasma membrane. Chara, Nitella, Nitellopsis cells, which are model objects, were used by us to conduct research in the described rash. The large size, transparency, and clear differentiation of the structural phases of these cells ensure the regular recording of their electrophysiological parameters with the application of the microelectrode technique while keeping them intact.

The aim of the research work was to reveal the possible structural lability of the plasma membranes of intact plant cells before their functional activity and electrophysiological analysis of these mutual events. In our scientific study, the solution of the following research questions is envisaged:

Differentiation of its electrical capacity into protein and lipid phases using the effect of protein-based agents that are substance transport modifiers in the plasma membrane; To carry out electrophysiological analysis of functional activity and structural lability of the plasma membrane using the effect of

lipophilic substances; Detection of its possible structural lability and electrophysiological analysis of this effect on the eve of the differentiation of electrogenic activity of the plasma membrane into channels and pumps;And so on.

We determined that, based on the analysis of the dependences of membrane potential (φm) and resistance (Rm), φm ([K+]) and Rm([K+]) in a wide range of concentration of K+ ions in the medium ([K+]), two types of K+ are present in the plasmatic membrane of Nitellopsis obtusa cells. - channel activity was determined, the composition of their conductances, the range of the membrane potential in the active state was determined. Based on the analysis of the reactions of changes in the transport properties of the plasmatic membrane under the influence of 2 types of antibiotics of protein nature and molecules with different conformations, it was determined that the insensitivity of the electrical capacity to those modifiers is related to the fact that the share of membrane proteins in the electrical capacity of the membrane is imperceptibly small. On the contrary, due to the effect of lipophilic substances (dimethylsulfoxide, dicyclohexylcarbidiimide) on the plasmatic membrane, a serious change in its electrical capacity was detected. From the analysis of these results, it was decided that the electric capacity of the plasma membrane is an indicator of its lipid phase, and at the same time, the electric capacity of the plasma membrane of plant cells is an indicator of the state of structural polarization of its lipid phase. The functional activity of H+- pumps of the plasma membrane is determined by its energy supply as well as by the physical state of the lipid envelope.

INSPECTION OF FLORA DIVERSITY IN DE-OCCUPIED AREAS

ABOUT MONOCOTYLEDONS OF ZANGILAN ADMINISTRATIVE DISTRICT

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Zangilan region which is liberated from occupation, has a rich landscape and plant diversity. Along with semi-desert and steppe landscapes, there are high mountain landscapes and alpine-subalpine meadows. The peaks of the area are Sighirt (1371 m), Gizgala (1023 m), Garaghanli (1168 m), Shukuretaz (2006 m) and Bartaz (2269 m) mountains. The Susenlidagh range stretches along Okchuchay.

Brown mountain-forest, old irrigated chestnut, floodable-meadow (alluvial-meadow), typical brown mountain-forest, dark mountain gray-brown, common mountain gray-brown and dark chestnut soils are spread in the area.

During the expedition period, eight species belonging to three families on monocotyledons were described in the area. These are families *Asparagaceae* (4 species), *Liliaceae* (1 species) and *Orchidaceae* (3 species).

Muscari caucasicum (Griseb.) Baker, *Muscari sosnowskyi* Schchian, *Muscari szovitsianum* Rupr ex Boiss. and *Ornithogalum montanum* Cirillo species belonging to *Asparagaceae* family are described. The species *Muscari sosnowskyi* Schchian is found in high mountain meadows at an altitude of 1800 m above sea level around Mount Shukretaz. The *Muscari caucasicum* (Griseb.) Baker and *Muscari szovitsianum* Baker species are distributed on the dry, stony, gravelly slopes of the hilly area at the entrance of Zangilan city.

The only species *Tulipa florenskyi* Woronow belonging to the *Liliaceae* family is found on the dry, clay-stone slopes on the left bank of Okchuchay, on the outskirts of Sayifli village.

The *Orchis simia* Vill., *O.caucasica* and *Ophrys caucasica* Woronov ex Grossh. species belonging to *Orchidaceae* family are described. These species are found in the oak woodlands and clearings after the forest in the foothills of Susanlidagh (Fig. 1.).

Figure 1. Monocotyledons found in Zangilan administrative district: a - *Muscari caucasicum* (Griseb.) Baker; **b -** *Muscari szovitsianum* Rupr ex Boiss.; **c -** *Muscari sosnowskyi* Schchian

FLORA RICHNESS OF BASITCHAY STATE NATURE RESERVE

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The Basitchay State Nature Reserve is one of Azerbaijan's most valuable natural monuments, known for its extraordinary natural beauty, biological diversity, and unique ecosystems. Located in the Zangilan district, the reserve covers the areas along the Basitchay river. This unique natural monument, located in the southeastern part of the Lesser Caucasus Mountains, has a mild warm climate with dry winters, with an annual rainfall of 600mm. The alluvial-forest soils in this area are very suitable for many plant and tree species. The rare oriental plane tree grows naturally in this area and forms forests. The creation of the Basitchay Nature Reserve, located at an altitude of 600-800 meters above sea level, was primarily aimed at preserving the natural habitat of the rare plane tree forest, which is the second largest in the world. It is worth noting that the reserve was established in 1974 at the initiative of national leader Heydar Aliyev. The reserve covers an area of 107 hectares, with the plane tree forest covering the majority of the forested area, although mixed forests have also developed in some parts. The main forested area covers 88 hectares.

After years of being under occupation, initial research conducted in the protected area of Basitchay has resulted in valuable findings about its flora. In the area of the reserve, which has a rich flora, it is observed that the plane tree, which occupies the first layer of the forest, forms a mixed wood with common walnut. The second layer of the forest is home to species such as *Celtis caucasica*, *Populus* L. (poplar), *Ulmus* L. (elm), and *Quercus longipes* L. (long-stalked oak) near the riverbanks.

If we classify the tree species according to their taxonomic composition, we find the following:

In forested areas located on the upper parts of the mountains: *Platanus orientalis*, *Quercus iberica*, *Juglans regia*, *Celtis caucasica*, *Morus nigra*, *Carpinus caucasica*, *Salix* L. *Juniperus depressa*, *Pistacia mutica*, *Populus* L. In dry and rocky areas: *Quercus araxina*, *Celtis caucasica*, *Carpinus orientalis*, *Pyrus boissieriana* Buhse, *Acer iberica*, *Ulmus araxina*, *Pyrus salicifolia*, *Juniperus foetidissima*, *Elagnus orientalis*. In areas with elevations between 800 - 1400 meters: *Amygdalus fenzliana*, *Amygdalis narica* Fed.et, *Diospyros lotus* L., *Juniperus foetidissima*, *Juniperus polycarpos*, *Taxus baccata* L., *Corylus colurna*, *Quercus longipes* Steven.

When we classify the plants that spread on the territory of the forest-steppe zone based on their taxonomic composition, we observe 10 species in the mountainous areas, 9 species in dry and rocky areas, and 8 species at an altitude

of 800-1400 meters. Let's list the observed herbaceous and shrubby plants separately: Shrubby plants: *Paliurus spina-christi*, *Sambucus ebulus*, *Punica granatum* L., *Cotoneaster integerrimus*, *Cotoneaster melanocarpus*, *Rhamnus pallasii*, *Berberis densiflora*, *Rosa sachokiana*, *Jasminum fruticans*, *Crataegus eriantha*, *Atraphaxis spinosa*, *Mespilus germanica*, *Pyracantha coccinea*, *Spiraea* sp., *Ephedra intermedia*, *Cerasus microcarpa*, *Lonicera iberica*, *Myriacaria squamosa*. Herbaceous plants: *Iris paradoxa*, *Andropogon* sp., *Teucrium* sp., *Thymus* sp., *Xeranthemum* sp., *Stellaria media*, *Poa annua*, *Geranium molle*, *Urtica dioica*, *Taraxacum vulgare*, *Crocus adamii*, *Ophrys caucasica*.

As a result of research in the area, 7 relic and endemic plant species have been identified, 5 of which are trees and 2 are shrubs. The Oriental Plane (*Platanus orientalis* L.), Caucasian Wingnut (*Pterocarya pterocarpa* Kunth ex I. Iljinsk.), Turkish Hazel (*Corylus colurna* L.), Foetid Juniper (*Juniperus foetidissima*) and Caucasian Persimmon (*Diospyros lotus* L.) found in the forest-steppe zone belong to the relic and endemic tree species. The Pomegranate (*Punica granatum* L.) and *Crataegus eriantha* A. Pojark. are among the relic and endemic shrubs. Rare and endangered plant species in the area have also been investigated, and a total of 17 trees, 6 shrubs, and herbaceous plants belonging to this category have been identified. In the territory of the Basitchay State Nature Reserve, 5 species included in the Red Book such as Oriental Plane (*Platanus oriaentalis* L.), Scarlet Firethorn (*Pyracantha coccinea* M.Roem.), Paradoxical Iris (*Iris paradoxa* Steven), Adam's Saffron (*Crocus adami* J.Gay.), and Khari-Bulbul (*Ophrys caucasica* Woronow) have been identified.

ASSESSMENT OF THE STATE OF LAKES AND FOREST COVER IN KALBAJAR REGION OF EASTERN ZANGEZUR DURING THE LAST 30 YEARS BASED ON GEOGRAPHIC INFORMATION SYSTEMS TECHNOLOGIES

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Using archival materials, GIS technologies and space imagery, the relief, climate, hydrography, vegetation, soil resources of the research area have been studied in detail, and information on existing mineral deposits in the area has been collected and mapped. Forest-vegetation cover (NDVI index) of the territory of Kalbajar region for different years: a) 1996; b) 2006; c) 2020, Kalbajar district NDVI index classification for different years: a) 1996; b) 2006; c) conducted for 2020 years. There are quite a few lakes in Kalbajar region, but the largest lakes are Boyuk and Kichik Alagol.

During the research, the Internet resources of the U.S. Geological Survey (USGS) (EarthExplorer) organization and, in accordance with the purpose of the research, multispectral images obtained from the Landsat-5 TM and Landsat-8 OLI satellites in GeoTIFF format were used. The following satellite images were used in the study:

- Landsat-5:

1. Multispectral_LT05_L1TP_169032_19860909_20170216_01_T1_MTL;
2. Multispectral_LT05_L1TP_169032_19960718_20180627_01_T1_MTL.

- Landsat-8:

We select our research area through the Clip tool of the images we receive. Multispectral images of Kalbajar region in 1986, 1996 and 2021 and Boyuk and Kichik Alagol of Kalbajar region in 1986, 1996 and 2021 are presented. Summarizing the results, we make a table:

Name of the lake	Field indicators in different years		
	1986	1996	2021
Boyuk Alagol	4,63	4,67	4,74
Kichik Alagol	0,65	0,62	0,53

Thus, according to the results we obtained, the area of the Boyuk Alagol has slightly increased over the years, but the Kichik Alagol has decreased.

BIOCHEMISTRY, BIOTECHNOLOGY OF USEFUL PLANTS AND ACQUISITION OF BIOLOGICALLY ACTIVE SUBSTANCES

CHEMICAL COMPOSITION OF THE ESSENTIAL OIL OBTAINED FROM THE STEM OF *PRANGOS ACAULIS* (DC.) BORNM

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Many species belonging to the genus *Prangos* Lindl. have different biological activities. These include antiviral, anti-cancer, anti-inflammatory, anti-diabetic and neuroprotective, etc. we can give an example. The genus has been used in folk medicine to treat some diseases such as headaches, leukoplakia, bleeding and indigestion, as well as as a spice, food, fodder and medicine. Due to their aphrodisiac, coagulant, carminative and tonic effects, various *Prangos* species are part of folk medicine.

The component composition of the essential oil obtained from the stems of *Prangos acaulis* (DC.) Bornm, belonging to the genus *Prangos*, was studied. The component composition of the essential oil was determined by Gas Chromatography/Mass Spectroscopy method. For this purpose, plant material (500 g) was collected from Ordubad district of Nakhchivan Autonomous Republic, dried, chopped into small pieces and essential oil was obtained by hydrodistillation method.

The analysis was carried out in a system including an Agilent 6890 N gas chromatograph connected to a high performance Agilent 5975 mass selective detector manufactured by Agilent Technologies (USA).

The yield of essential oil was 1.2±0.15%. In total, 62 components were identified in the composition of essential oil. The components in high abundance in the essential oil were sesquiterpene compounds. In addition, monoterpenes, triterpenes, alkanes, fatty acids, coumarin, etc. compounds were defined.

NEXT GENERATION SEQUENCING TECHNOLOGIES ACCELERATE SECONDARY METABOLITE PATHWAYS DISCOVERING IN MEDICINAL PLANTS

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Despite the large volume of data obtained on the components of extracts and essential oils of medicinal plants, due to the lack of in-depth genomic and transcriptomic studies, the biosynthetic pathway and the enzymes involved in these pathways remain unknown in most medicinal species. Precise studies using emerging technologies (e.g. NGS) based on whole genome and transcriptome sequencing in this field will not only be able to identify key genes involved in the synthesis of important compounds but also provide important side effects such as the development of high-throughput molecular markers. New "omics" procedures (e.g. NGS) are facilitating the discovering of key regulating enzymes involved in various secondary metabolite biosynthesis pathways. The number of these genes discovered using whole genome sequencing studies, reveals a wider structural diversity than previously expected. Genomic studies (functional and comparative) can assist to better identify the biotransformation of these phytochemicals. In addition, RNA-Seq method would be used for depicting the expression status of the genes in plants with or without available reference genome sequence. NGS-based methods can identify genes involved in the biosynthetic pathway of important metabolites including, phenolics, terpenoids, alkaloids, glycosides, and etc. Subsequently, by metabolic engineering, it is possible to produce the desirable quantity of a natural substance in various herbals and develop cultivars with suitable medicinal properties. Finally, this technology along with other new biotechnology methods will lead to better understanding of evolutionary events of different genes; reconstruct genetic diversity patterns between plant taxa, and more effective marker assisted selection (MAS) that ultimately help to domesticate wild medicinal plants. Therefore, domestication of these plants using modern breeding programs and cultivation of improved cultivars with desirable characteristics can minimize the risk of extinction of these species.

CHEMICAL COMPOSITION OF PLANTS BELONGING TO THE GENUS ST.JOHN'S-WORT AND THEIR APPLICATION IN MEDICINE

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The chemical composition of species belonging to the genus St.-John's-wort is chemically rich. Species belonging to the genus contain secondary metabolites, flavonoids, anthracene derivatives, essential oils, polyphenol compounds, etc. The following biologically active compounds were obtained from the composition of *Hypericum coadunatum, H. perforatum, H. Maculatum, H. hirsutum H. tetrapterum* species by means of high-efficiency liquid chromatography, NMR-nuclear magnetic resonance, UV-ultraviolet, IR-infrared and mass spectroscopic analysis methods: mangiferin, avicularin, kaempferol glycoside, kaempferol rutinoside, hypericin, pseudohypercin, catechin, epicatechin, cinnamon, chlorogenic, neochlorogenic, vanillic acid, quercetin, rutin, bisapigenin, diquercetin, hyperoside, as well as hyperforin, β-sitosterol, estrogen, etc. Diantrone anthracene derivatives identified from St.-John's- wort species *H. empetrifolium, H. sinaicum* species: hypericin, protohypericin, pseudohypericin, protopseudohypericin, cyclopseudohypericin, as well as hyperforin, adhiperforin. Physicochemical constants, spectroscopic (-UV) ultraviolet, IR-infrared, ^{1}H-NMR proton magnetic resonance, mass spectroscopic interpretations of some of these compounds are shown below. *Hyperforin* $C_{35}H_{54}O_4$, m.t.= 79-80°C, UV spectrum (ethanol)) λ_{max} =275 nm), ^{1}H NMR- spectrum: deuterium chloroform CDCl3 (δ m.h.): 4,8-5,3 (m, 4H, H-15, H-22, H-27, H-32), 4,2-4,3 (m 2H, H-14), 3,20 (m, 1H, H-11), 1,8-2,5 (10H, H-6, H-7, 2H-19, 2H-21, 2H-26, 2H-31), 1,5-1,8 (m, 28H, CH_3), 1,20 (s, 6H, CH_3-12, CH_3-13), 1,00 (3H, CH_3-20). Hyperoside $C_{27}H_{30}H_{16}$, m.t. = 233-235 °C, (aqueous acetone), UV spectrum (ethanol) λmax =258, 266, 362 nm), PMR deuterium acetone and deuterium aqueous mixture (2:1), (δ m.h.): 12.30 (s, 5-OH), 7,92 (d, J=2,5 Hs, H-2'), 7,55 (d.d, J1=2,5, J= 9 Hs, H-6'), 6,88 (d, J= 9 Hs, H-5'), 6,45 (d, J= 2,5 Hs, H-8), 6,21 (d, J= 2,5 Hs, H-6), 5,20 (d, J= 7,5 Hs, H-1" galactose), 3,5-3,6 m, 6 H, galactose). Rutin $C_{27}H_{30}O_{16}$, m.t. = 192-194 °C, (water-alcohol), UV-spektrum (ethanol) λmax =258, 266, 362 nm), 1H NMR- spectrum: deuterium acetone and deuterium aqueous mixture (2:1), (δ m.h.): 7,74 (d. J=9 Hs, H-2'), 7,68 (d.d, J1=2,5 J2= 9 Hs H-6'), 6,94 (d, J=9 Hs, H-5', 6,50 (d,J= 2,5 Hs, H-8), 6,27 (d, J=2,5 Hs, H-6), 5,13 (d, J= 7 Hs, H-1"-glucose), 4,55 (d, J= 2Hs, H-1'" - rhamnose), 3.70-3,25 m, 6H glucose ++4H rhamnose), 1,08 (d, J= 6 Hs, 3H, CH_3 rhamnose). “Novoimamin”, an

antibacterial drug of common St.-John's wort, affects gram-positive microbes, including penicillin-resistant staphylococci. It is used in burns, abscesses, phlegmons, infected wounds. Decoction and infusion of common St.-John's wort is used against rheumatism, esophageal diseases (ulcer, gastroenterocolitis, diarrhea), liver, gall bladder diseases, cystitis, haemorrhoids, gingivitis, stomatitis, and other diseases. St.-John's wort oil (oily extract of the herb) is applied in the form of a compress in the treatment of wounds, ulcers, burns, etc. Hypericin provides a sedative and hypnotic effect. Common St.-John's wort is an ingredient in many teas and infusions. It is used in diabetes in the composition of “Arfazetin” and “Mirfazin” preparations.

FATTY ACID COMPOSITION OF *RHUS CORIARIA L.* SEED OIL

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Sumac (*Rhus coriaria* L.) from *Anacardiaceae* Lindl. is widely distributed in all botanical and geographical regions of Azerbaijan. The species distributed from the lowland to the middle mountain belt along the edges of the forest, among shrubs, on stony and rocky places. Forms thickets and grows in groups. The extracts obtained from various organs of sumac have antioxidant, antimutagenic, antiischemic, antidiabetic, antibacterial, antifugal and other activities.

As is known, vegetable oils are the main food components, providing a person with such essential fatty acids as linoleic, linolenic and arachidic, which are not synthesized in the human body. They are very valuable in the production of medicines. It has not been studied precisely the seed oil composition of *Rhus coriaria* growing in Azerbaijan. Therefore, the purpose of this work was to study fatty acid composition of sumac seed oil.

Plant material was collected during the period of full ripeness of the fruit from Siyazan region of Azerbaijan Republic. The seeds, dried at 105°C were crushed and ground with a grinding mill. Then the crushing seeds were extracted with n-hexane at 60°C in a Soxhlet apparatus for 8 h. The fatty acid composition was established by gas-liquid chromatography on chromatograph "HP" series 6890 with a flame ionization detector. The separation was carried out on a 100 meter capillary column "Agilent 112-88A7".

Chromatographic analysis of the fatty oil of pomegranate seeds made it possible to establish the presence of 15 higher fatty acids. The main part (97.56%) of fatty acids (in total) are linoleic (57.91%), oleic (29.14%), palmitic (7.34%) and stearic (3.17%) acids. The smallest amount falls on the share of other fatty acids. The fatty acid composition of sumac seed oil shows that it can be used as a drug in medicine and a biologically active additive in the production of food and cosmetic products.

PROTECTIVE ROLE OF PHOTOSYNTHETIC MEMBRANE AGAINST OXIDATIVE STRESS BY *DANAE RACEMOSA* EXTRACT

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Oxidative stress caused by the negative effect of environmental conditions on vegetation seriously damages the biological cell and causes the increase of reactive oxygen species (ROS). An intensive search is underway for natural antioxidants (AO) to prevent increasing ROS during oxidative stress. For this purpose, the extract of the leaves of the relict plant *Danae racemosa* growing in the Central Botanical Garden of the Republic of Azerbaijan, which has a rich photochemical composition, was taken in our research. AO activity of the *Danae racemosa* extract was determine by the standart Trolox –DPPH reaction was used. As can be seen, the study of the quenching of the stable radical DPPH trolox showed an inhibition concentration (IC) 50–17.1mg/ml and the inhibitory concentration of the extract at 60mg/ml was (IC) 50=55.4 mg/ml. The comparative effect of both wheat leaves (*in vivo*) and chlorophyll-protein complexes (CPC) (*in vitro*) isolated from chloroplasts subjected to various stresses with 2% *Danae racemosa* extract was studied.

In both cases, stress causes destructive changes in photosynthetic pigments (Xl *a* and Xl *b*), weakening of cell membrane permeability, and blocking of electrons transported in the electron transport chain of PS II. The obtained results showed that the direct addition of exogenous *Danae racemosa* extract to the medium stabilizes the light-harvesting CPC and regulates the permeability of the thylakoid membrane due to the accumulation of photosynthetic pigments and the normalization of their ratio. Restoration of the electron transfer reaction in the electronic transport chain of PS II is observed. AO activity was studied with DPPH reaction of the extract. The obtained value indicates that the extract of *Danae racemosa* has a low molecular AO, that is, protective property against stress.

MINERAL NUTRITION OF SOIL MICROALGAE

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Macroelements and microelements are of great importance in the nutrition of microalgae. Various nutrient media have been established for mineral nutrition of microalgae isolated from eroded soils. For example, BG11+ nutrient medium is enriched with nitrogen and is used to grow green soil algae.

Bold's Basal Medium (BBM) has long been used as the main nutrient for growing filamentous Klebsormidium flaccidum (Kutzing) and spherical green algae from eroded soils. The main composition of all microalgae growing nutrients are micro and macro elements. Nitrogen. The importance of nitrogen is determined by the level of the biosynthesis process. If there is a lack of nitrogen in algae, the cell does not reach the normal size, its mass and diameter are increased by lipids. Lipid globules gradually begin to occupy a larger part of the cell. After adding nitrogenous compounds to the alga growing food, the green color of the alga increases, the globules in its cytoplasm disappear and turn yellow. Accordingly, processes caused by nitrogen deficiency are reversible processes. As a source of nitrogen for algae, experts have conducted a number of experiments, nitrogen, potassium, nitrate, sodium nitrate, ammonium sulfate, ammonium nitrate, urea are convenient compounds for them to absorb, the amount of which depends on the goal of the researcher. Most often they use NONO3 or KNO3. Phosphorus, as the main element, is second only to nitrogen in the metabolism of algae. All processes that take place with the participation of phosphorus are related to it. Phosphorus is part of the constitutional compounds in algal cells. They are as follows: Phosphoprotsides, Complex esters of Phosphoric acid, Phospholipids and others. Algae use phosphorus as PO4; They get free of ions in the form of HPO4. Phosphorus is partially extracted from organic compounds. The lack of phosphorus in microalgae has a negative effect on assimilation processes. This causes cell division to slow down first. When there is a lack of nitrogen in the biochemical composition, the amount of carbohydrates increases. Dependence of the temperature of the environment in which algae grow in phosphorus uptake. When the temperature decreases, the amount of phosphorus in the cell decreases. Experts prefer to use KH2PO4 for algae. Potassium is considered necessary for the formation of these organic compounds in algae cells, even though this element is not included in the composition of carbohydrate lipids, which cannot be replaced in the mineral nutrition of algae. Absorption of potassium from algae Chlorella, Scenedesmus,

cyanoprokaryotes Nostoc commune into cells is an active metabolic process associated with autotrophic or heterotrophic (glucose) nutrition. Lack of potassium in microalgae leads to a sharp decrease in photosynthesis, accelerates the respiration processes, that is, the decomposition of organic matter. Increasing lack of potassium leads to chlorosis. If potassium is added to the food, the process goes back to the original. Lack of potassium to microalgae is not felt under natural conditions, because potassium in the water is sufficient for them.

EFFECT OF SALT STRESS ON THE RESPIRATORY AND PHOTOSYNTHESIS PROCESS

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During salt stress, the photosynthesis process in plants undergoes certain changes, mainly its intensity decreases. This occurs as a direct or indirect effect of salt stress. As the salinity increases, secondary effects arise directly due to stomatal closure, thickening of the mesophyll layer and reduction of CO2 absorption, dispersion of photosynthetic pigments, weakening of photosynthetic metabolism, and the creation of direct or oxidative stress. Tiwari et al., in their experiments with rice (Oriza sativa) seedlings, determined that the absorption of photons with a wavelength of 680 nm in the absorption spectrum of FSII decreases in parallel with increasing salinity. During salt stress, the changes in the transport of important ions, including Na+ ions, and their absorption into the cytosol, have a dramatic effect on the absorption of photons in the reaction centers of photosynthesis, as well as on the electron-transport chain, and thus on the formation of ATP and NADPH molecules in FSII, as well as also has a negative effect on the enzymatic activity of the Calvin cycle . By measuring the kinetics of chlorophyll fluorescence radiation, they determined that changes in the structure of chlorophyll a and chlorophyll b pigments occur during salt stress and their amount decreases. For example, they observed a sharp change in the intensity of chlorophyll fluorescence in almond tree seedlings when the salinity level was higher than 0.3 dS/m. Other scientists have also studied the effect of stress factors on the photosynthesis process and the physiology of photosynthetic pigments with fluorescence radiation of chlorophyll. The reasons for the decrease in the intensity of photosynthesis in plants exposed to salt stress can be explained in two ways; with and without mouthpiece-dependent causes. In most of the experiments, the limitations caused by salinity in the photosynthesis process are explained by conditions that do not depend on stomata. In stress reactions that occur in such cases, salinity is directly involved in photon absorption and energy transfer processes as a non-photochemical factor. In stomata-dependent limitations of photosynthesis, the parameters of photosynthesis, including CO2 assimilation, gas exchange and transpiration, are drastically reduced. However, here salt shows its negative effect only by changing the potential of water. As a result of extensive research, it has been found that the effect of salinity on the respiratory process occurs mostly in the stages of germination, fruiting, and bushing of plants. The results of experiments show that oxygen absorption decreases by 35-55% at a concentration of 0.1 M

of NaCl salt. The increase in the intensity of respiration during salt stress is caused by the operation of three systems - electron transport, energy transfer, and the common point for electron transport with energy transfer. At this time, firstly, plant cells lose their principle mechanism for collecting energy as a result of ATP breakdown, and secondly, the separation of oxidation and phosphorylation processes creates peroxidation in the phospholipid phase of biological membranes. As a result, free radicals of fatty acids are formed. An excess of peroxides uncouples oxidation from phosphorylation, and mitochondrial swelling occurs. It has been confirmed in experiments that mitochondria swell during salt stress. The formation of free radicals causes the cell's antioxidant system to activate, and other sources of salt tolerance are activated. Therefore, an inversion is observed in salt resistance. This proposed mechanism well explains the initial increase in respiration intensity during salt stress and its decrease during ongoing salt stress. Thus, the substrate intensity of respiration under salinity conditions depends on a number of factors, the most important of which is the duration and degree of salinity and the variety of plants.

NEUTRALIZING PROPERTIES OF FREE RADICALS IN EXTRACTS OF ALBEDO AND INNER PART OF TANGERINE

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In recent years, the violation of the ecological situation on earth has sharply affected living systems, including human health. It has been established that environmental conditions and stress increase the formation of free radicals in the body. The increase of free radicals in the body causes a person to develop cardiovascular diseases, cancer, Alhzeimer's disease, Parkinson's disease, etc. However, the antiradicals formed in the cell perform a defense function by neutralizing free radicals. The chemicals that destroy free radicals are antiradials. There is an opportunity to eliminate free radicals in the body, but this is not infinite. Antioxidants and antiradicals formed in the cell extinguish free radicals. However, when an excess amount of free radical is formed, they are taken externally in the form of drugs. We have explored a more natural way to do this.

It is known that medicinal and useful plants are widespread in Azerbaijan. The local varieties of citrus origin, which are widespread in the south, there are oranges, lemons, tangerines, feijoa, kinkan, etc. an example can be given. Separation of antiradical compounds from natural sources would be appropriate to use production waste. Antiradical compounds were obtained from the albedo and inner part of tangerine. Previously, a water-alcohol extract was prepared from the albedo and inner shell part of tangerine. The DPPH method was used for the analysis. Various volumes (2, 5, 10 and 20 ml) of the extract were added to 2.5 ml of DPPH and for a period of 20 minutes an absorption of 518 nm was determined.

It has been established that the activity of the inner membrane of the tangerine is greater than that of the albedo part. It is believed that the thin upper shell of the tangerine can cause this. To extinguish 50% of the DPPH, the albode fraction inhibitor of naringin was observed 150, and the inhibitor of the inner part of tangerine 43.5. It has been established that the water-alcohol extract of tangerine and tangerine inner membrane contains high-activity phenol and bioflovonoid origin of antiradical compounds. Comparative experiments have shown that the most active compounds of antiradical origin are observed in the inner membrane of tangerine. Since the production of citrus fruits introduced in Azerbaijan mainly in Lankaran is widely spread, we offer to create waste-free processing by obtaining antiradical compounds from waste.

RESEARCH OF THE FUNCTIONAL ACTIVITY OF POLYENE ANTIBIOTICS IN DIFFERENT CROPS

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One way to preserve the purity of ecosystems is the use of polyene antibiotics with specificity and selectivity of their action on viral and fungi plant cells. In the process of our prolonged scientific activity on the base of polyene antibiotics was discovered a new membrane-active preparation whose basic action is connected with its ability to quickly, high selectivity, and efficiency to destroy simultaneously viral and fungi infections of plants. The most effective of the studied PA were amphotericin B and levorin A_2, produced respectively by soil microorganisms *Actinomyces nodosus* and *Actinomyces levoris*. A theoretical analysis of practical aspects of the use of PA is presented in order to develop an ecological model of environmental protection from carriers of infection. The relationship between the structure of antibiotics and their function in membranes has been established. The physicochemical properties and biological role of dimethyl sulfoxide (DMSO) in combination with PA were studied for the first time. It was found that the use of amphotericin B and levorin A_2 in the DMSO complex enhances the biological activity of the initial antibiotics. It was found that the studied antibiotics have a steep dependence of conductivity on their concentration, which made it possible to identify the effective concentrations of each of them in the formation of ion channels. Proceeding from these data concentration of an antibiotic which corresponds to its maximum biological activity is calculated. At small 10-1 M of INFANVIR concentration on single ionic channel with the low conductivity which size about 0.3-0.5 pSM are formed in membranes. Research showed that INFANVIR the forming molecular complex at interaction with cytoplasmatic membranes, promotes suppresion of virus and fungoid infections of vegetable and other types of crops. The biological activity of PA increases sharply in DMSO solutions. PA in DMSO solution are about 10 times more effective in comparison with initial water-soluble forms of antibiotics. INFANVIR contains DMSO and an active component that allows to use it at treatment of viral and fungoid diseases of vegetable crops in the structure. INFANVIR possesses ability to interact with envelops of virus particles and membranes of fungi cell. There is the lysis of cells as result of such interaction. Studies conducted in

greenhouses, as well as in open fields, of the preparation "INFANVIR" showed high effectiveness of its effect on pathogenic microorganisms. The initial solution of 100 ml of preparation of viral (Tobacco mosaic virus) and fungal infected plants and soil was dissolved in 10 liters of water (temperature -15-35^0). As a result, this operation led to the complete destruction of viral and fungal infections. It has been shown that drug users can completely suppress the growth of the tobacco mosaic virus. In particular, it should be noted that after treatment with "INFANVIR," the infected plants are not only cured but also complete recovery of the plants occurs. In addition, vegetable plants treated with the drug had twice the yield of control plants. The conducted research allowed to theoretically substantiate and present practical recommendations for the targeted synthesis of PA and their derivatives with specified properties. For example, alkylation of the polar part of PA molecules increases the biological activity and selectivity of their action on cell membranes. As a result of the conducted research, for the first time it was possible to identify a new compound Infanvir, which has the ability to effectively and selectively suppress the growth of pathogenic viral infections in plant cells. A Eurasian patent has been obtained for the developed drug.

AMINO ACID COMPOSITION OF THE SPECIES OF THE GENUS *PRUNELLA* L.

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The quality of nutrition and the therapeutic value of plants depends not only on the content of amino acids in them, but also on their qualitative composition, especially on the presence of essential amino acids with therapeutic effect. Analysis of the qualitative composition of the amino acid complex of various species of populations shows that, regardless of the population, species contain essential amino acids, such as lysine, valine, histidine, methionine, leucine, isoleucine, phenylalanine, arginine, threonine. Analysis of the quantitative and qualitative composition of the amino acid complex in the flowers and leaves of the species of the genus *Prunella* proved the difference between the species. As follows from the table, the amino acid composition of *P. grandiflora P. laciniata* and *P. vulgaris* species is not identical, but the composition of amino acids in each species remains unchanged regardless of the place of its growth. The amino acid composition of *P. grandiflora* and *P. vulgaris* consists of 16 amino acids - histidine, asparagine, serine, proline, glutamic acid, methionine, alanine, tyrosine, valine, phenylalanine, leucine, isoleucine, arginine, threonine, glycine. In the leaves of the species *P. vulgaris* there is no methionine tyrosine, isoleucine, valine. In the leaves of the species *P. grandiflora* there is no arginine, threonine, glycine. The amino acid composition of *P. laciniata* consists of 13 amino acids of lysine, histidine, asparagine, serine, proline, glutamic acid, tyrosine, valine, phenylalanine, leucine, isolucine, threonine and glycine. The species studied differ from each other in the number of individual amino acids. The main part of the amino acid complex in all species is aspartic acid, glutamic acid, leisin. Amount of glutamine as p. grandiflora varies in flowers from 0.65 to 0.70%, leaves from 0.52- to 0.84%. This component in the growing Girdmanchay population is larger than in plants from the Valvalachay population. In the amino acid complex, histidine and methionine account for the least. Comparative chromatographic analysis of different species shows that amino acids are unevenly distributed among the leaves and flowers of the plant. Some amino acid components are twice as large in flowers. For example, in *P. vulgaris* flowers from the Valvalachay population, the amount of lysine in the flowers is 0.25%, and in the leaves - 0.13%. Usually, there is a greater accumulation of amino acid components in the flowers. It's probably likely

associated their synthesis mainly in flowers. This is most likely due to their synthesis mainly in flowers. Since assays are carried out in the mass flowering phase, it can be assumed that amino acids in the mass flowering phase are synthesized more often in flowers. It was determined that amino acids in high content accumulate on plants from Talistan in the Girdmanchay forest population than on plants from the Valvalachay population.

COMPLEX EFFECT OF MOLYBDENUM AND SALINITY ON NITROGEN METABOLISM AND ACTIVITY OF THE PROTEASE SYSTEM OF PUMPKIN PLANTS (*CUCURBITA PEPO* L.)

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Among all environmental pollutants, heavy metals (HM) are the most common and most dangerous elements of the biosphere, since they do not undergo physicochemical or biological degradation, they accumulate in the surface layer of soils, changing their properties, and remain available for root absorption for a long time and can be bioaccumulated by living organisms. With increasing soil pollution, HM and their salinization, which negatively affect the growth and development of plants, the number of wild and cultivated plant species decreases, their distribution area narrows, and the fodder and nutritional value lessens. In this work, we studied the specifics of the responses of a pumpkin glycophyte plant subjected to the simultaneous action of two toxicants - an excess of molybdenum and sodium chloride, on the accumulation and distribution of protein nitrogen, changes in the activity of proteolytic enzymes in different organs depending on the duration of their exposure. Five-day-old seedlings were transplanted into Knop's nutrient solution (1N, pH 6.0) in 4 variants of the experiment: 1. Control (nutrient solution-NS); 2. NS + NaCl (0,1 M); 3. NS + $(NH_4)_6$ Mo_7O_{24} *$4H_2O$ (30 μm); 4. NS +NaCl (0,1 M) + Mo (30 μm). Samples of plants from all variants were taken for analysis in three periods every 7 days. The activity of proteolytic enzymes for the content of various forms of nitrogen was determined according to the generally accepted methods described earlier. Plants for their normal growth require a tiny amount of molybdenum. As Mo is present in saline soils in trace amounts, excess Mo is highly toxic to plants. Under saline conditions, under the influence of molybdenum, the activity of xanthene dehydrogenase and nitrate reductase increases, especially in the roots. Treatment of plants under conditions of high salinity (200 mM NaCl) increased the activity of aldehyde oxidase associated with the synthesis of abscisic acid, which plays a significant role in plant adaptation to stress conditions, much more strongly in roots than in leaves. It is known that the growth of the organism is carried out mainly by the biosynthesis of proteins and other nitrogen-containing compounds, which requires the presence of nitrogen in the cell. The analysis of the obtained data showed that

under the combined action of molybdenum and NaCl, there is a slight decrease in the inhibitory effect of excess Mo on the synthetic and metabolic processes occurring in experimental plants at later stages of their development, especially in the root system of 21-day-old plants. This is evidenced by higher values of biomass, water, root/shoot ratio in terms of biomass content in the roots of plants treated with molybdenum under saline conditions than in plants that received only molybdenum. However, on the 21st day of the experiment, the results of which are most indicative in terms of adaptive rearrangements in both roots and stems, the content of protein nitrogen was noticeably higher in the combined use of Mo and NaCl than in the variants of their single use. One of the stress-induced rearrangements of nitrogen-protein metabolism is a change in the activity of the proteolysis system involved in it, the functional proteins of which play a protective role in cells and in increasing the adaptive capabilities of the plant organism. The observed increase in the protease activity of 21-day-old plants under the combined action of NaCl and Mo compared with the variant with only Mo is almost 2 times and even with the control (by 33%), which enhances the breakdown of proteins into amino acids and the creation on their basis of new protective protein substances specific for stressful situations contributed to the survival of the plant as a whole in these extreme conditions.

FORMATION OF CHLOROPHYLL-PROTEIN COMPLEXES OF WHEAT CHLOROPLASTS UNDER THE ACTION OF MANGANESE IONS

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It is known that function of manganese ions in green plants is its participation in the photosynthetic oxygen evolution. PSII contains a mangano protein that catalyzes the initial steps of oxygen evolution. A decrease in photosynthesis with an excess of manganese in the leaves is proposed as one of the mechanisms that determine the toxicity of manganese.

We studied the toxic effect of the Mn2+ salt on the development of reactions responsible for the delayed chlorophyll fluorescence in the millisecond time range in 8-day-old wheat (*Triticum aestivum*) seedlings grown under low pH conditions.

The chlorophyll-containing profile and the profile of chloroplasts stained with Coomasie blue isolated from wheat seedlings during greening (from 6 to 48 hours) showed that in the absence of manganese ions (control) CPIa (110 kDa), oligomeric form LHC (94 kDa), monomeric form RC PSI - CP (68 kDa), dimeric form LHC2 (47 kDa), PSII reaction center - CRa (43-45 kDa).) and the monomeric form of LHC (23 kDa) and their apoproteins.

The treatment of seedlings with Mn ions caused a significant degree of degradation of LHC (23 kDa) and CPa (43–45 kDa) with respect to CPIa, LHCI, and CP of chlorophyll-containing subunits. Coomasie blue staining did not reveal apoprotein degradation in the 23 kDa and 43-45 kDa regions. In addition, under conditions where the effect of Mn2+ ions is manifested, profiles containing chlorophyll and stained with Coomasie blue consistently show an increase in the concentration of complexes with higher molecular weights (110, 94, 68 kDa).

Under the action of manganese ions, the absence of the oligomer and dimer, as well as the monomer of light-harvesting complexes, is also observed. This can be explained by the fact that proteins that should interact with chlorophyll changed their configuration under the action of Mn ions, which led to the cessation of the biosynthesis of the light-harvesting complexes.

Thus, it can be assumed that manganese ions disrupt not only chlorophyll biosynthesis, but also prevent the formation of chlorophyll-protein complexes.

COTONEASTER MEDIK FROM *ROSACEAE* FAMILY: STUDY AND USE OF VARIOUS BIOLOGICALLY ACTIVE SUBSTANCES OF *COTONEASTER* SPECIES

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Various biologically active substances contained in some wild plants belonging to Rosaceae family are widely used in the treatment of many diseases. The study and rational use of natural plants used in pharmaceuticals can be considered as a source for the Gulchichekli family, along with various plants, due to their pharmacological properties. Aqueous extracts from wild medicinal plants and dried form are more commonly used. Juices and extracts from freshly harvested medicinal plants are used immediately. This is mainly due to the lack of long-term storage. Sometimes, the presence of a complex of various biologically active substances causes hydrolytic decomposition as a result of the activity of enzymes in plants that do not obey in the natural state. It is advisable to use a collection that is fresh and can be quickly processed immediately to preserve the pharmacological properties. The main method most often used is preservation and drying under natural conditions. In addition to organic matter, plants also contain minerals, which are found in ash when suspended. The composition of minerals in plants depends on the composition of the soil, humidity, plant biology, etc. It can change depending on it. Macro and micronutrients can be found in plants belonging to the family of flowers. It can change depending on the specificity of macronutrients. *C. integerrimus* Medik., Gesch. - Full margin leaf d.1m tall shrub (nanophanerophyte), flowering occurs in May-July. Fruits ripen in August. It is crimson in color, up to 1 cm in diameter, balloon-shaped or egg-shaped. Its seeds are propagated by birds. It is found in the upper mountain belt and subalpine slopes up to 2200 m, on stony and rocky mountain slopes, in thickets around the forest, in open areas. It is a light-loving, drought- and heat-resistant plant that grows in sunny places. It is not demanding on soil, it grows well in calcareous soils. It is distinguished by its high resistance to winter. The healing properties of whole-leaved rabbit apple were known in ancient China and Central Asia. In ancient times, due to its beneficial properties, wine obtained from the fruit of the common cotoneaster growing on the outskirts of the steppe was used in the treatment of many diseases. This also eliminated stomach and intestinal problems. When used for therapeutic and preventive purposes, fruits and flowers have a beneficial effect on the cardiovascular system, normalization of digestion and pressure, elimination of insomnia, nervous tension and excessive diseases. It helps the

development of metabolic processes in the heart muscle, expands blood vessels. In addition to flavonoids, dry and fresh fruits contain plant polyphenols, anthocyanins, tannins, polysaccharides, phenolcarboxylic and organic acids, oils, as well as macro and microelements, vitamins useful for the human body in fruits and flowers. These are carotene, provitamin A, C, E, K. and also iron Fe, magnesium Mg, potassium K, calcium Ca, sugar, sorbitol, zinc, manganese, copper and tannin trace elements. The species is described from Europe. It refers to the geographical elements of Euro-Caucasus. (Pl.).

BIOLOGICALLY ACTIVE SUBSTANCES AND ANTIFUNGAL PROPERTIES OF *CEPHALARIA MEDIA* LITV.

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Dipsacaceae Lindl. family in the flora of Azerbaijan consists of 7 genera and 250 species. Some of them have been used in folk medicine for various diseases since ancient times. The genus *Cephalaria* L. belongs to the *Dipsacaceae* family and is represented by 7 species in the flora of Azerbaijan. *Cephalaria* species with rich chemical composition are known as medicinal plants. For example, the flowers of the *C. quqantea* (Lebed.) Bobr. and *C. ensifolia* Rich. species are used for respiratory and liver colds. In case of cough, infusions are also used for diaphoretic properties and against fever. *Cephalaria* species are rich in alkaloids, triterpene saponins, flavonoids and other biologically active substances. The alkaloid gentianin has anti-inflammatory, antipyretic and sedative properties. Sucrose, glucose and *β*-sitosterol were found in the roots of *C. kotschyi* Boiss. & Hohen. species. Preparations obtained from the flowers of *C. kotschyi* have an antiviral effect against enteroviruses. Oleanolic acid and hederagenin were obtained as a result of acid hydrolysis of sinnaroside, quercimerithrin, and saponins sums from the inflorescence of *C. media* Litv, an endemic species for the Caucasus. Sweroside, loganozid, cantleioside, steroid from iridoids from the roots of *C. media* species; and from triterpene compounds – *β*-sitosterol, ursolic acid were separated and identified. *C. media* is a perennial herb 50-80 cm tall. The leaves are pinnately divided. The flowers are light yellowish in color. It blooms in July-August, seeds in August. It is found in Guba, east and west of the Great Caucasus, in the south of the Lesser Caucasus from the lower mountain belt to the upper mountain belt in dry grassy slopes, thickets, dry mountain slopes. The best result of contact of extractive substances of *C. media* species with *Aspergillus niger* pathogenic fungal cultures was observed in *Trichoderma lignorum* fungal test culture. All concentrations of aqueous extract of *C. media* species (5, 10, 15 g) had a fungicidal effect on *Aspergillus niger*, and a fungistatic effect on *Trichoderma lignorum*, *Fusarium oxysporium*. The obtained results allow to recomment using of the aqueous extract of *C. Media* as an antifungal agent in the future.

FOLK MEDICINE, AROMATHERAPY, PHYTOTHERAPY AND PHYTOPREPARATIONS

COMPARATIVE EVALUATION OF HERBAL IMMUNOSTIMULANTS IMUNEO AND HEDALIN ON IMMUNE INDICATORS IN BIRDS VACCINATED AGAINST INFECTIOUS BRONCHITIS

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In recent years, an increase in the number of infections with infectious diseases has been observed in modern poultry industries due to the weakening of the immune system. The prevalence of secondary immunodeficiencies depends on the number of birds collected in a certain area, stress factors and the quality of food. Basically, immunodeficiencies occur in birds whose immune response mechanism is not fully formed. In this regard, the use of immunostimulants in the poultry industry is considered important. Herbal immunostimulators have received much attention in recent years. Herbal immunostimulators, unlike others, have the following advantages: mild immunostimulatory effect, low toxicity, stimulation of the immune, endocrine and nervous systems. In connection with the above, the use of herbal immunostimulants is promising. The purpose of the study was to evaluate the immunostimulating effectiveness of the new complex herbal preparation Imuneo and Hedalin syrup.

An experiment was conducted on 30-day-old broiler chickens in Neftchala, Ujar and Shabran regions of the Republic. Initially, vaccines against infectious bronchitis of chickens were used. 350 broiler chickens of the ROZ 308 breed were used as the main object to study the indicators of the immune status during the use of an immunostimulant against the background of IB vaccination. Herbal Imuneo and Hedalin syrup containing vitamin complexes were used as immunostimulators. First, it was used together with the vaccine at a dose of 13 liters / ton in the first 3 days before vaccination. The toxic properties and harmlessness of these preparations have been studied on laboratory animals. To determine the toxicity of Imuneo herbal preparation and Hedalin syrup, it was tested on birds and white mice. The observation was carried out for 3 weeks. Signs of intoxication and pathological changes in internal organs were not detected. In order to study the effect of Imuneo and Hedalin syrup on the immune system during vaccination, the birds were divided into 5 groups according to the analogue principle, with 50 birds in each group.

Group I - chickens are vaccinated against IBV with CeVak I Bird vaccine by drinking water, group II - birds are vaccinated together with Imuneo, in this group the drug is given consecutively for 3 days before vaccination, then vaccination, and after vaccination. On the 5th, 6th, and 7th days, the immunostimulant is given again. Group III - To study the effect of Hedalin syrup on the immune system, the birds were fed by drinking water. Group IV - birds were given Hedalin syrup along with CeVak I Bird vaccine. In this group, the syrup was used for 3 days in a row, then the vaccination was carried out, and the immunostimulant was given again on the 5th, 6th and 7th days after the vaccination. Group V was the control group - birds were not vaccinated and were not given Imuneo and Hedalin syrup. 3 weeks later, after vaccination in all groups, blood was taken from the subclavian vein of the birds and immunological studies were performed. A significant increase in the number of immune indicators was observed when evaluating the immunological status of birds in all experimental groups. The combined application of Imuneo and Hedalin syrup in birds led to a noticeable increase in bactericidal and phagocytic activity. Thus, after the introduction of Imuneo, the phagocytic activity of macrophages increased by 22.5%, and by 15.3% in group IV. Also, in the 2nd and 4th experimental group, the bactericidal activity of blood serum was recorded as 29.1% and 20.5% compared to the control group. Thus, the immunostimulating drug Imuneo has a strong immunostimulating effect. Hedalin, in addition to the immunostimulating effect, has a microbicidal effect, in this regard, no opportunistic infections were found in these groups during the experiments.

PLANTS THAT CAUSE ALLERGIC DISEASES ON THE EXAMPLE OF COMMON IN SAMARKAND

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Pollinosis is a group of allergic diseases characterized by acute inflammatory changes in the mucous membranes and skin caused by plant pollen. The disease has a seasonality that coincides with the flowering period of certain plants and is recurrent. The nature and strength of the clinical manifestations of pollinosis depends on the degree of increased sensitivity of the body to pollen allergens, accompanying allergic reactions and diseases. Pollinosis is caused only by pollen, which has an allergenic property, belonging to common plants pollinated in the wind, they produce a huge amount of small and volatile pollen. Depending on the flowering period of different plants, there are three peaks of the incidence of pollinosis: spring, summer and autumn. In some patients, the clinical picture of pollinosis can be observed throughout the entire period from spring to late autumn.

Pollen allergies are usually caused by wind-assisted pollination plants because their airborne pollen content is much higher than the pollen content of plants pollinated by insects. The release of pollen from wind-pollinated plants occurs early in the morning, but its amount in the air usually reaches its maximum in the afternoon. This is due to the high circulation of air during these hours of the day. In dry weather, even under the influence of light winds, the concentration of pollen in cities can be very high. The allergenic properties of pollen can persist for a long time. When it rains, pollen almost completely disappears from the air.

Each region has its own flowering calendar of plants. In Samarkand, we divided the formation of plant pollen into three periods. In the spring period (April-may), the flowering of trees is recorded (birch, oak, poplar, willow, Maple, Pine, etc.). At the beginning of summer (June-July), flowering of Spike grasses (sowing rye, corn) is observed. At the end of summer (July-August - early autumn), flowering of herbaceous plants (Wormwood, Japanese saffron, Chrysanthemum, Nettle) was observed in the ham of trees and shrubs in sheep.

In conclusion, for allergy sufferers, plants such as birch, poplar, willow, oak are more dangerous than other trees and shrubs. If the cold lasts longer, it affects the viability of the generative organs of plants. This accelerates the duration of allergenic diseases.

STUDY OF ESSENTIAL OIL FROM COMMON CHAMOMILE USED IN MODERN MEDICINE

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More than 40% of modern medical preparations are obtained from plant raw materials. The main reason for this is that herbal remedies are close to the natural metabolites of the body due to their structural characteristics, they are not harmful and can be used for a long time without causing adverse effects. Chamomile plant is one of the plants that can be used as a raw material in medicine and cosmetology. There are 50 species of chamomile in the world flora. Chamomile belongs to the Asteraceae or daisy family. Although there are a number of species known only as chamomile, only three of them are used medicinally. The most famous is *Chamomilla recutita* or Matricaria (Medicinal chamomile), German chamomile, Hungarian chamomile, false or wild chamomile. These are the same chamomiles that are familiar to everyone with their white and yellow flowers. Another popular species of chamomile, Anthemis nobilis is commonly known as the Roman and English chamomile. It is cultivated as a medicinal plant in England, Belgium, France and the United States. The difference between it and wild chamomile is that the yellow flower base is hollow, and the aroma is more effective and pleasant. Common chamomile and fragrant chamomile (*Chamomilla suaveolens*) are found in 3 species of the genus in the Caucasus, including mainly 2 species in Azerbaijan. Common chamomile species are widespread in the Ganja-Gazakh region of Azerbaijan. Based on the analysis of landscape and geological factors, we selected the common chamomile plant growing in the plain area of the Western region (geographical coordinates 41°05′ 36" N. 45°21′ 58" N. N) in the study. An annual herb, common chamomile is a medicinal and aromatic plant that blooms white flowers between May and August.

The primary raw materials were collected from natural biosenos in the first week of every month from May to September. Biologically active components from chamomile flowers were separated by extraction method. Chamomile flowers are rich in biologically active substances and are the main source of raw materials in the preparation of medicinal (cosmetic) preparations. That is why, in recent years, different types of pharmaceutical and cosmetic products obtained from chamomile extract are widely used in medicine and cosmetics (pharmacology). The results of the study of the essential oil obtained from the hydrodistillation of the chamomile plant growing in the western region

were presented. The average amount of essential oil from the hydrodistillation of chamomile flower was determined to be 11.1±1.24%. The main elements that determine the therapeutic properties of medicinal and aromatic plants are the active substances in its composition. The ratio of essential oil in essential oil plants varies depending on many factors such as the genetic structure of the plant, plant organs (morphogenetic variation), the period of plant development (ontogenetic variation), temperature changes during the day (daily variation) and climate and environmental factors. Chamomile essential oil is a highly viscous liquid, dark blue to blue-green in color, with a characteristic aroma: balsamic, honey, and partially reminiscent of blossoming apple. For this reason, it is used in perfumery, especially because it gives a pleasant smell and aroma. Chamomile flowers are used in medical practice as anti-inflammatory (anti-inflammatory) and antispasmodic (spasmolytic, pain-relieving) means. Chamomile oil is used as a lotion in various allergic reactions in folk medicine. Chamomile oil is also used in aromatherapy. Most of the mentioned beneficial properties of chamomile are due to the presence of biologically active substances such as α-bisabolol, bisabolal oxides and chamazulene. In addition to the therapeutic effect of chamomile, it is also widely used in the cosmetic industry. Especially due to its ability to eliminate irritation, as well as its deodorizing and bactericidal effect, it is used more often in various products, it is preferred in the preparation of cleaning and skin care products (especially intended for children), in preparations used in sun protection compositions.

THE ROLE OF ESSENTIAL OIL PLANTS OF THE NORTH EASTERN SLOPES OF THE LESSER CAUCASUS IN THE PROCESS OF DEHELMINTHIZATION OF LIVESTOCK

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The northeastern foothills of the Lesser Caucasus include areas with unique climatic conditions, soil and vegetation. The regions located in this area are characterized by rich flora and fauna.

The northern regions of the Lesser Caucasus include the Ganja-Dashkasan and Tovuz-Gazakh regions. Samukh, Goygol, Goranboy, Dashkaesan, Shamkir, Gadabey, Tovuz, Aghstafa and Gazakh economic regions are located in the Lesser Caucasus. The richness of the region's flora and the effective use of these plants in the development of animal husbandry are topical issues.

The richness of the flora of the region and the effective use of these plants in the development of animal husbandry are topical issues. Despite the formation of different types of vegetation in the flora of the Lesser Caucasus, essential oil, vitamin, medicinal and fodder plants are not fully studied. Soil cover of the Lesser Caucasus consists of mountain-meadow, mountain-meadow-steppe, mountain-chernozem, mountain-forest brown soils, mountain-forest carbonate-meadow, mountain-meadow, gray-meadow, meadow-gray-meadow soils, alluvial-grass lands.

Availability of quality winter and summer pastures is one of the important factors of livestock development and increasing livestock productivity. Animal health and livestock production growth largely depend on the supply of forage plants rich in vitamins. The meadows and pastures of the Lesser Caucasus are rich in vitamin-rich essential oil plants. People in this region also use essential oil plants to treat various diseases. In Ganja-Dashkasan and Tovuz-Gazakh zones it is necessary to transfer small horned animals to summer pastures so that these animals are healthy in winter. Of particular importance for the health of small ruminants is the intake of plants containing vitamin C and E.

With a lack of vitamins C and E, reproductive functions of animals are weakened, avitaminosis occurs in animals. There are many data in the literature that vitamins A, D, E, C and group B are important factors in animal health and reproductive process. It should be noted that there are few research works on the

necessary level of forage plants to provide animals with vitamins, and the study of this area is one of the urgent requirements of the modern era.

Livestock farms located in the northeastern areas of the Lesser Caucasus move from plains and some foothills to mountainous areas by various migration routes. In order to study the species composition of the helminth fauna of small ruminants in all landscape-ecological zones of the Lesser Caucasus economic region, studies were conducted in the summer pastures of Safikurd, Koroghlu Daresi, Kepaz, Khachbulag, Duzrusullu, Sarytala, Kiren, located in both mountainous and foothill areas of the region. At the same time, studies were continued in wintering areas located in the plain areas of the region, located around the settlements of Jeyranchol and Zayam.

In these areas conducted a study of helminths 957 heads of sheep and 619 heads of goats, which were fed on meadowsweet, thyme, St. John's wort, wormwood, *harmala, Centaurium pulchellum,* and others anthelmintic effect of plants is confirmed by caprological studies. As a result of antihelminthic action of these plants recorded increased milk yield of animals, improved coat quality and weight gain.

CHANGE IN THE RESOURCE POTENTIAL OF MEDICINAL PLANTS OF THE LOWER AMUDARYA TUGAI UNDER CONDITIONS OF ANTHROPOGENIC DESERTIFICATION

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Currently, the natural environment of the Amudarya Delta is undergoing rapid changes. These changes are linked to the development of negative processes such as desertification and aridification. On the one hand, this is due to a sharp increase in water extraction from the river and regulation of its flow, and on the other hand, to an increase in anthropogenic pressure and changes in climatic conditions, which have led to changes in the structure and dynamics of the tugai phytocenosis in the Amu Darya delta. These processes have mainly affected the medicinal plant resource potential of riparian forests in the Amu Darya delta through anthropogenic impacts on their growing environment and uncontrolled medicinal plant harvesting. In the solution of the problems of the conservation of the resource potential and the biodiversity of the medicinal plants in the Tugai, the main attention is paid to the protection of the species richness. Intraspecific variability, which ensures the sustainability of adaptive potential under the conditions of anthropogenic transformation of the tugai environment in the Amudarya Delta, has not yet been sufficiently studied, especially using the latest modern research methods. As a result of the irrational use of the arable land, the excess of anthropogenic pollution exceeding the threshold of sustainability of the natural tugai ecosystem, the anthropogenic desertification of the territory develops, a complex of degrading processes connected with the reduction of the biological productivity and medicinal plant species of the tugai in the downstream reaches of the Amudarya. Therefore, measures to increase the productivity and sustainability of medicinal resources, counteracting multiple degradation factors of the natural system, are paramount. As a result of the unregulated harvesting of liquorice root and the intensive development of floodplains for agricultural crops in the lower reaches of the Amu Darya River, the natural thickets of liquorice have been destroyed.

According to modern information, more than 1100 species of higher plants grow on the territory of Karakalpakstan, of which more than 410 species are medicinal plants used in scientific and folk medicine. However, not many of them are used for practical purposes. Lack of complete information about useful

properties and chemical composition of Karakalpakstan's plants is an obstacle to attracting new plant species for use in medicine and various economic sectors. As a result of research, it has been established that there are 190 species of medicinal plants used in scientific and folk medicine in the floodplain and delta of the Amudarya River. Since the 70s of the last century, great attention has been paid to the rational use of plant resources of the Republic of Karakalpakstan for the needs of the national economy. At that time scientific-theoretical researches on useful properties and value of vegetative communities of medicinal plants of the Tugai delta of the Amu Darya were carried out. In our opinion, obtained new results on distribution of price complexes of some species of medicinal plants in formed new ecological conditions of the lower reaches of the Amudarya will help to use different groups of medicinal plants in a new way.

Thus, in connection with the current ecological conditions in the Tugai forests of the Amu Darya delta, there is a need to study the current state of medicinal plant resources in the conditions of anthropogenic desertification, to address issues of biodiversity conservation and their rational use. The developed science-based methodology provides an opportunity to implement measures for the conservation of wild medicinal plant species and the rational use of biological natural resources of the tugai forests in the lower reaches of the Amu Darya River.

SOME ESSENTIAL OIL PLANTS OF *ANTHEMIDEAE* CASS. TRIBE

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There are 106 species in 11 genera in the Azerbaijan flora of the *Anthemideae* Cass. tribe of the *Asteraceae* Bercht. et J.Presl family. Many species of the tribe are economically important and are used as medicinal, essential oil, food, rubber, decorative, and dye plants. According to the research, essential oil was determined in 40 species of the tribe. Information about some of them is presented.

Achillea nobilis L. is common wild in all botanical-geographical regions of Azerbaijan, starting from the lowland to the subalpine mountain belt, along roadsides, crops, forests, gravelly, calcareous slopes and river stones. *A. nobilis* is a perennial herb, a mesoxerophyte, belonging to the boreal geographic type and the paleoarctic class. It has been determined that it contains essential oil, vaccines, alkaloids, sesquiterpenoids and flavonoids. It is important as essential oil, medicinal, decorative plant. Essential oil has a fungicidal and antimicrobial effect. In the flowering phase, the yield of essential oil in the aerial part is 1.1%. Citronellal (27.4%), camphor (20.2%), 1,8-cineole (14.1%) are the dominant components of the essential oil.

Achillea filipendulina Lam. is distributed wild in all botanical-geographical regions of Azerbaijan, starting from lowland to mid-mountain and sometimes up to the upper mountain belt on roadsides, in the foothills, around crops, in mountain meadows. *A. filipendulina*, perennial herb found in the semi-desert vegetation type, is a xeromesophyte, belongs to the desert geographical type and the Turan class. It has been determined that it contains essential oil, mono- and sesquiterpenoids, flavonoids and carotenoids. It is important as essential oil, medicinal, decorative plant. Essential oil has a fungicidal and antimicrobial effect. In the flowering phase, the yield of essential oil in the aerial part is 1.0%. Linalool (17.3%), 1,8-cineole (14.6%), n-cymene (9.4%), camphor (7.6%) are the main components of essential oil.

Tanacetum parthenium (L.) Sch.Bip. is a perennial xerophytic plant found in rock crevices and stony slopes in the middle and upper mountain belt in the northern and central part of the Lesser Caucasus, as well as in the districts of Nakhchivan AR. It belongs to the xerophilic geographical type. It is important as an essential oil, decorative plant. The essential oil shows antifungal activity. In the flowering phase, the yield of essential oil in the aerial part is 0.3%. Cis-geraniol (45.46%) is the dominant component of the essential oil.

Tanacetum balsamita L. is a perennial mesophytic plant found in northern, central part of the Lesser Caucasus in Azerbaijan, the mountainous part of Nakhchivan, in moist or swampy meadows of subalpine and alpine mountain belts, on the banks of mountain streams. It belongs to the xerophilic geographical type. Essential oil, vitamins C, B_1, B_2, flavonoids, phenolcarbonic acids were found in the plant. This plant is known as an essential oil, medicine, food plant, and is also used in the perfumery and cosmetics industry. Essential oil has a fungicidal and antimicrobial effect. In the flowering phase, the aerial part contains 0.6% essential oil. Camphor (25.29%) and borneol (21.84%) are the major components of the essential oil.

Conyza canadensis (L.) Cronq. is an annual or biennial xeromesophyte plant. It can be found throughout Azerbaijan, from the lowland to the lower mountain belt, in dry riverbanks, forests and bushes, gardens, and sometimes meadows. It belongs to the Haloarctic element. It has been determined that it contains essential oil, flavonoids, saponins, alkaloids, vaccines, vitamin C, resin, aldehydes. Essential oil has a fungicidal and antibacterial, astringent effect. It is known as essential oil, medicinal, food plant. In the flowering phase, the yield of essential oil obtained from the aerial part is 0.8%. Limonene (77.5%) is the dominant component of the essential oil.

ESSENTIAL OILS OF SOME CONIFEROUS PLANTS CULTIVATED IN AZERBAIJAN

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This paper provides quantitative and qualitative analysis by GC-MS of the essential oils extracted from *Juniperus sabina* L., *Calocedrus decurrens*, *Pinus pinaster* Sol. and *Pinus eldarica* Medw. from Azerbaijan were been carried out. Essential oils of families *Cupressaceae* and *Pinaceae* and their components are they have an interest in the food and pharmaceutical industries as natural antioxidants. Pine needles essential oils are mainly used in folk medicine for the treatment of cardiovascular and cholesterol lowering benefits, respiratory infection, they have anti-inflammatory effects and the ability to enhance microcirculation.

The aim of our study is to elucidate the chemical composition of essential oils obtained from of *J. sabina*, *C. decurrens*, *P.pinaster* and *P.eldarica* grown in Baku. Essential oils were extracted from by hydro-distillation. The chemical composition of the obtained essential oils was analyzed using GC-MS technique. *J.sabina* L. is a perennial shrub, native to the mountains of central and southern Europe and western and central Asia, and eastern Siberia. The essential oil and extracts from *J. sabina* find application in medicine, food industry, and agriculture. *J. sabina* is widely cultivated and used for the landscape gardening. The essential oil content in *J. sabina* was 0.4-0.7%. The sabinene, γ-terpinene, 2-carene, and terpinene-4-ol as the major constituents were tentatively identified. The yield of essential oils reached 0.2 % for *C. decurrens*. The thymoquinone, carvacrol and p-methoxythymol as the major constituents were identified. The essential oils of *Pinus* species demonstrate antimicrobial and promote blood circulation. Pine oil has also been used as a component of aromatherapy recipes. *P. pinaster* Sol. and *P. eldarica Medw.* is widely cultivated and used for the landscape gardening. *P.pinaster* Sol. was broadly distributed under Mediterranean climates of Europe, as well as in some north western African. The essential oil content in the needles and twigs of freshly collected plant material *P. pinaster* was 0.1-0.3%. The major chemical constituents of essential oil were of the α-pinene, β-pinene, β-phellandrene and β-caryophylene. Turpentine oil from *P. pinaster* is officinal in European

Pharmacopoeia. The essential oil content in the needles and twigs of freshly collected plant material of *P. eldarica* was 0.3-0.6%.

The essential oil has a yellow color with characteristic pleasant smell. The major chemical constituents of essential oil were of the α-pinene and 3-carene are main, as well as β-myrcene, camphene, muurolol and others.

PROVIDING PHYTOTHERAPEUTIC KNOWLEDGE TO BIOLOGY STUDENTS IN SECONDARY SCHOOLS

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The great leader H.A. Aliyev advised young people to value their time, spend it effectively, and take care of their health. He appealed to them not to waste your years, not to lose your youth, take care of your physical health, you should live a healthy lifestyle. His wills have given us teachers an important task of imparting medical-hygienic knowledge to students in the teaching of subjects in schools.

Possibilities of problem solving in biology teaching were investigated. In the scientific-methodical literature, there was no research work or special work on providing phytotherapeutic knowledge to students. Secondary school textbooks were analyzed in terms of problems. It turned out that topics such as the structure, composition, importance of plants and their use in the treatment of diseases are mainly intended for classes VI-VII. In the last teaching unit of the biology textbook of the 6th grade, the role of plants and animals in human life is given topics on "Medicinal plants". Raspberry, thyme, rose hips, mint, chamomile, and plantain plants are mentioned there. Information about them is offered to students. Here it is shown that saffron is widely used in diseases of the cardiovascular, nervous, excretory and reproductive systems. Pumpkin seeds are used in the treatment of diabetes, heart and kidney diseases against worm diseases. In our republic, the fruits of the rose hips, sedum, thyme, blackberry, elderberry, flowers and fruits of hawthorn, oak bark, etc. it is collected and given to pharmaceutical establishments, medicine is prepared. At the end of the subject, giving various tasks on phytotherapeutic knowledge makes the students more active.

In the 7th grade biology textbook, “Stifftails and plauns. The importance of kizhikimis”, “Class of bivalves. Cruciferous and cruciferous families”, “Dicot class. Leguminous and Aubergine family”, “Dicot class. In the topics such as “The family of anemones”, “Medicinal properties of medicinal plants and the rules of their use”, it is noted that medicinal plants are one of the broad groups of plants used for therapeutic and preventive purposes in folk medicine, medical or veterinary practice. In the text, the medicinal properties and pictures of a number of medicinal plants (valerian, elecampane, rosehip, sedge, thyme, nettle, hawthorn, licorice, etc.) are given. The rules of collection and storage of medicinal plants are indicated.

A number of teachers organize more interesting topics on imparting phytotherapeutic knowledge and skills. One of such teachers is Sadagat Aliyeva at Ecology High School No. 291, N.Narimanov District, Baku. In her classes, she focuses on imparting practical skills as well as theoretical knowledge of phytotherapy. So, in the 7th grade, on the topic of "Medicinal plants and their use", she brewed rose hip, thyme, chamomile, calendula flower, mint, hawthorn, and tea and offered the students to drink them. In the fourth lesson asks how the herbal infusion affects the students' mood when they are tired. Students expressed their opinion about the effects of the infusion on their bodies. They demonstrated their knowledge of medicinal plants. In order to further consolidate phytotherapeutic knowledge in the memory, the teacher instructs the students to prepare the "Medicinal plants" calendar and booklet . Students prepared the corresponding booklet and calendar.

USE OF WORMONY PLANT IN OINTMENT AND SOLUTION FORM IN FOLK MEDICINE

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Plants enrich atmospheric air with oxygen, and are the main and inexhaustible source of a number of therapeutically important substances, including effective medicinal preparations. In this sense, the flora of Azerbaijan can be considered as a source of plants rich in biologically active substances. In one of the ancient legends, it is said: that country is rich and its people are happy, that there is a field of wormwood deeply rooted on the chest of its land. The area is reminiscent of a quiet fall aspen forest, a swirl of bluish smoke, and a melancholy humming watermill.

Asteraceae Dumort is one of the main representatives of wild useful, aromatic and aromatic-spicy plants in the flora of Azerbaijan. (*Artemisia* L.) is a genus belonging to the *Asteraceae* family. Wormwood-(*Artemisia* L.) is taken from the Greek word "artemisia" and means "healthy", "strong". It is an annual, biennial, perennial semi-shrub and herb.

Tu Yu, a Chinese pharmacologist who believes in ancient medicine, discovered artemisinin, a sesquiterpene lactone, in 1972 by studying wormwood. In 2015, it achieved high efficiency by including artemisinin as the main component of medicines used in the treatment of malaria, which seriously damages people's health. Because of this, he was awarded the Nobel Prize in medicine. The composition of wormwood species is rich in minerals: vitamins C, PP, B6, B1, B2, A.

Wormwood and substances obtained from them are used in different ways in local and foreign folk medicine. The bitter substances in its composition stimulate the function of the gastrointestinal and sub-gastric glands, increase the activity of the central nervous system and the circulatory system, antipyretic and antitussive substances are used in the prevention and treatment of malaria, flu and acute respiratory infections accompanied by temperature. Due to its appetizing and astringent properties, it can be used for gastritis, stomach ulcer, dysentery, rheumatism, anemia, jaundice, migraine, hypertension, pulmonary tuberculosis, edema, rheumatism, etc. is used during some types of wormwood are considered the most effective means of fighting cancer. In folk medicine, wormwood is applied externally (on the skin) in the form of ointments and solutions to treat various diseases. Sometimes the question arises, if the ointment

is applied to the skin, what benefits the internal organs see. Of course, when placed on the skin, it is absorbed through the skin and has a general effect on the body. Since wormwood contains all minerals and active compounds, the movement function of the liver, the amount of incoming blood, oxygen, and nutritious minerals increase. With this, inflammation is eliminated. The most important thing is that it is possible to use wormwood throughout the year (in all seasons). It is known that there is no greenery in autumn and winter, the plant dries up, and the above-ground parts remain on the stem. In this case, ordinary dry wormwood is collected, kept in water for 1-2 hours, then wrapped in salafan, softened after a day and passed through a meat grinder, used abroad as a medicine. In folk medicine, ointment (ointment) made from leaves, flowers and roots of wormwood is used to heal boils and treat various wounds.

Wormwood, which has unique properties, is a useful medicine and an important plant for livestock feed.

Considering that polymort wormwood (*Artemisia* L.) species are irreplaceable in the fight against many diseases due to the wide spectrum of therapeutic use. Therefore, it is recommended to use this rich natural resource efficiently and preserve it for future generations.

INDUSTRIAL IMPORTANCE OF PLANT INTRODUCTION AND CULTIVATION

MAIN TREATING TO THE SOIL IN THE DIFFERENT PERIOD AND THE EFFECTIVENESS OF APPLYING A SERHOSIL BIOPREPARATION DURING THE COTTON VEGETATION PERIOD

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In developed countries of the world, while scientific work is carried out on applying minimal processing technology to the soil, based on soil, and climatic conditions, the research on plowing has not lost its role. Special attention is paid to conducting scientific research that improves the agrophysical and agrochemical features of the soil and preserves and increases soil fertility. The use of promising agrotechnical methods and biopreparations in obtaining a stable high yield from agricultural crops give good effect.

The aim of the research was to study the effect of biopreparation SERHOSIL and soil treatment for different periods and methods on cotton biometric indicators and productivity. The object of research was biopreparations SERHOSIL consisting of 3 species of green microalgae belonging to the Scenedesmus genus, Bukhara 102 cotton variety, and old irrigated typical grey soils of the Tashkent region. In the experiments, the soil was ploughed with a regular plow in autumn and summer and with the disc plow in summer.

During the research, it was found that in the background of all type of ploughing the treating the seeds with biopreparation SERHOSIL before planting and feeding through the leaves twice during the vegetation season had a significant positive effect on the cotton's biometric indicators during the entire vegetation period.

In the phenological observations, it was found that during the cotton budding period, in the variants processed with autumn plough (plow), summer ploughing plow and with the disk, the height of the cotton stem consisted 33.2; 31.5 and 30.1 cm, the number of buds 5.3; 4.9 and 4.7 and the number of yield branches 5.0; 4.5 and 4.4 units.

In the background which autumn ploughing (plow) carried out, in the SERHOSIL biopreparations applied option, the height of the cotton stem was equil to 38.7 cm, the number of buds 5,5 and the number of yield branches 5,3 units and comparing with the control variant it was higher for 5,5 cm, 0,2 and 0,3 units. It was identified that in summer, in the options which ploughing

carried out with plow and disk, above given parameters were equal to 70.4-63.4 cm and 4.9-4.7 and 4.8-4.6 units, and in this background on the experimental options which treated with SERHOSIL biopreparations the plant height was higher 2.2-1.1 cm and the number of buds were more 0.4-0.3 and 0.4-0.3 units than comparing with its contol versions. In the experimental variants, the weight of one pod was higher than in the control variants, and the additional yield consisted of 2.4 - 3.4 centner/h.

In conclusion, it was found that the use of SERHOSIL biopreparation has a positive effect on the growth, development and productivity of cotton when the soil is cultivated in different periods and methods.

THE IMPORTANCE OF *GINKGO BILOBA* L. IN THE URBAN ECOSYSTEM

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Samarkand is one of the oldest cities in the world, not only rich in ancient and historical architectural monuments but also one of the cities with wonderful flora. The Spanish tourist Rui González de Clavejo wrote in his travel memoirs about Samarkand: "The whole city is surrounded by gardens and vineyard, the outskirts of the city are surrounded by so many gardens and vineyards that the more you go to it (the whole) consists of tall trees it seems to be the forest, and in the middle is the city located itself".

Natural monuments in the ecosystem of Samarkand city, particularly two-lobed ginkgo (*Ginkgo biloba*, *Taxodium distychum*, *Juniperus virginiana* L., *Sequajadendron giganteum*, *Cedrus libani*, *Pinus pallasiana*, *Platanus orientalis*, *Quercus robur*) rare trees such as are also of great importance, and these planted rare trees have been giving aesthetic beauty to the city. Unfortunately, over the years, the death of many rare trees and shrubs in the city of Samarkand has increased artificiality in the city's ecosystem. Therefore, we must not forget that the city's variety and abundance of trees and plants are a "source of life" for life.

Among such rare trees, the place of Ikki bo'lakli Ginko (*Ginkgo biloba* L.) is incomparable. The height of this tree is 15-18 m (40-50 m in its homeland). There are two types of branches: long-growing branches, in which the leaves are located one after the other, and fruit-bearing branches, in which the leaves are in clusters. The leaves are fan-shaped, the length is 10 cm and the width is 10-12 cm, the edges are straight, slightly curved, and the length of the leaf band is 10-12 cm. Ginkgo blooms in the May-June months. The flowers are small and invisible. The fruit ripens in October-November. The fruit is elongated, ovoid, similar to plum fruit and fragrant when used. Ginkgo with its shiny green and large leaves creates a beautiful landscape in spring and summer. It currently grows naturally in China.

CULTIVATION TECHNOLOGY OF SUNFLOWER PLANT IN GANJA-KAZAKH REGION

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Sunflower is an annual plant of the family of aster, genus *Helianthus annus*. The sunflower has a strongly branching taproot. It develops 2 times faster than the root of the embryo and works 2-4 meters deep into the soil.

The research was carried out in the practice field of Fahrali. The sunflower is a demanding plant for heat, light, moisture and nutrients. Seeds begin to germinate at a soil temperature of 4-6 0C. At such a temperature, seedlings are formed in 20-30 days. At a temperature of 8-10°C, seedlings are formed in 15-20 days, at a temperature of 15-16°C - in 9-10 days, and at a temperature of 20°C - in 6-8 days. The total active temperature from seeding to receiving outputs is 140-160 0C. Sunflower seeds, sown in the ground, tolerate short-term frosts well. Therefore, seeds can be sown in the ground in autumn and early spring.

Requirements for moisture are different. So, sunflower is less demanding of water from the moment of sprouting to the flowering period. During the period of flowering and pouring of grain, the sunflower's need for moisture increases. In this period, the need for moisture is 75% of the total need for vegetation. During the growing season, one plant consumes 200 kg of water. One of the important agro-technical measures for obtaining a high yield is the introduction of organic and mineral fertilizers. Healthy and mature large seeds of the first reproduction of zoned varieties and hybrids should be used for sowing. Germination of seeds should be no less than 96%, and purity - 99%. To increase germination, the seeds are laid out and dried with hot air. Early sowing can be carried out at a temperature of 5-7 0C in the sowing layer of the soil. Seedlings are obtained faster at a daytime temperature of 10-12 0C. Sowing is carried out in early spring at the end of February-beginning of March. Lately, sunflowers are cultivated by the point sowing method with young rows, etc. e. with spacing of 70 cm. The distance between the plants in the rows should be 30-40 cm, 3.0-3.5 plants per meter.

The normal seed planting depth is 6-8 cm, in dry conditions it is 8-10 cm. Promethrin or Treflan herbicides are used against weeds at the rate of 2-3 kg per hectare. Although the sunflower is a drought-resistant plant, in order to obtain a high yield during cultivation, it is necessary to have a large supply of moisture in the soil. Cleaning is carried out when 90% of the baskets become yellow-brown and dry. At this time, the humidity reaches 12-14%. Humidity in the basket is 70-75%, and in the barrel is 60-70%. Harvesting should be

completed within a short period of 4-5 days. Seeds are stored in a layer (thickness) of 1 meter. Moisture content of seeds stored in bags should be close to 8-10%.

After harvesting the crop, many impurities remain - stem, basket and leaf particles. Since these mixtures are wet in relation to the fabric, it is important to clean them immediately after collection. Freshly picked seeds are left for ripening 25-30 days after harvesting. To speed up this process, the seed material is cleaned from other mixtures and dried until the humidity remains at the level of 8-10%. Seeds are collected at a height of 0.4 m in places of their storage.

ISSUES OF INTRODUCTION OF THE RADDE'S BIRCH IN ABSHERON CONDITIONS

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In modern times, the protection of biological diversity, the preservation of plant species with decreasing species number and range is one of the most important problems ahead. These problems are one of the urgent issues that humanity facing, waiting for their solution soon, and the implementation of which falls on every member of society.

Taking this into account, we carried out research on the rare and endangered Radde's birch distributed in the northeastern part of the Greater Caucasus (Azerbaijan).

Radde's birch (*Betula raddeana* Trautv.) belonging to the birch (Betula L.) genus of birch family (Betulaceae S.F.Gray) is a rare, endemic species to the Caucasus.

Radde's birch grows naturally in the Guba, Gusar districts of Azerbaijan at an altitude of 1500-2100 m above the sea level in the composition of birch forests.

It is included in the Red Book of Azerbaijan as endangered plant.

According to the Red List of IUCN, the category and status of the species belong to the category of "Vulnerable to extinction".

Radde's birch was introduced to Central Botanical Garden in 2017. The seeds of the species were collected from forests near Kuzin village of Gusar district.

In order to accurately assess the degree of adaptation of the species to new conditions, it is necessary to study the growth characteristics of the plant. We have studied the growth characteristics of Radde's birch in young and old state in Absheron conditions.

In Absheron conditions, the cotyledon leaves emerge on the soil surface when the seeds of the Radde's birch germinate. The first 1st pair of true leaves appear 3-4 days after the cotyledons, and the 3rd true leaf 8-9 days later. True leaves grow quickly.

In Absheron conditions, the growth of birch begins in March and ends in July-August.

In the first year, the height of the seedlings reaches 13 cm, and lateral branches from the 1st degree are formed on them. The height of two-year-old seedlings reaches 19-20 cm, three-year seedlings reach 25-27 cm. There are 7-8

branches and 45 leaves on the seedlings. Seven first-degree branches and 12 second-degree branches are formed on the four-year seedlings. From the 1st degree, the length of the branches can reach up to 23 cm.

The height of 5-year seedlings of Radde's birch reaches 35-37 cm.

In Absheron conditions, the beginning of vegetation of Radde's birch was considered to be opening of shoots, and the end of vegetation - shedding of leaves (up to 50%).

The phenological observations conducted in Absheron conditions showed that vegetation of the Radde's birch begins in the first decade of March and ends in the first decade of October. The vegetation period of the species in Absheron conditions lasts 216 days.

Radde's birch successfully completes its vegetation in the dry subtropical climate of Absheron.

Research work on Radde's birch is being continued.

BREEDING *ANUBIAS BARTERI* IN AN AQUARIUM. THE ANUBIAS PLANT IS AN AQUATIC PLANT GROWN IN AQUARIUMS AND TERRARIUMS

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Anubias barteri is distributed in swampy areas of Eastern and Equatorial Africa and on the island of Fernando Po. The leaves together with the stems reach 30 cm. The rhizome is slippery, thick, fleshy, sometimes branching, and the lateral roots penetrate deeper into the soil. The leaves are fleshy, asymmetrical, lance-shaped, variable from green to fine green, shiny on the top, velvety on the bottom, the base is thick, the oval is slightly retracted. In young plants, the ratio of leaf length to width is 2:1. The broadest part of the leaf is in the middle, it descends towards the top, and it is sharpened at the end. In mature plants, the base of the leaf is slightly incised and the basal wedge is drawn. The main vein of the leaf is well visible, forming a rib on the underside, and the side veins are less visible. The length of the stem is approximately equal to the length of the leaf. An adult plant can be transplanted into aquarium soil or clay pots. As a substrate, they use a mixture of large-grained sand, peat fragments and oily clay. It is better to add charcoal to this mixture. The plant grows well when the water level in the aquarium is low. Lighting should be sparse and weak from above. The top of the aquarium should be covered with glass, and the water should be well ventilated. The temperature should be 28 ^{0}C. A well-developed plant can produce baby plants, which should be separated from the mother plant after they have at least 3 leaves. It is better to grow them in an orangery at a temperature of 26 ^{0}C, because in this case the plants develop faster. In particular, they should be protected from direct sunlight. When exposed to direct and long-term sunlight, the leaves of the plant are covered with thick algae on the upper side, after which those leaves twist and become wrinkled.